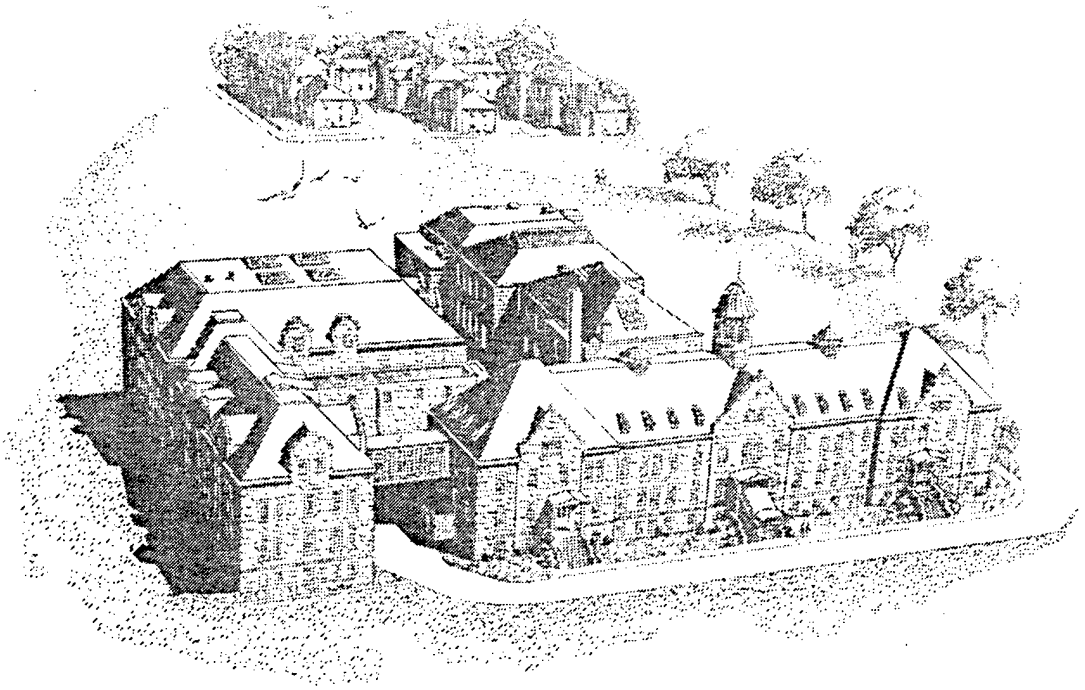
JOINT AIR TRAFFIC CONTROL

AN OPERATIONAL RISK MANAGEMENT APPROACH (U)



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15.Abstract: The armed services face a difficult environment as they attempt to balance diminishing resources with growing missions. This environment is particularly problematic for the military air traffic control community due to increases in its dual mission of providing nearly one-fifth of all air traffic services in the National Airspace System and supporting military readiness as a major component in the force training and sustainment base. Current oversight mechanisms have recently allowed individual service air traffic systems to develop pervasive problems, indicating they may be inadequate to ensure consistent performance and safety--whether or not in turbulent times. Oversight is not centralized--either at the DoD level or within three armed services. Most of the services do not conduct routine analysis of system safety indicators and air traffic has not consistently been an area of emphasis for the service safety centers. Sharing of information between the services and with the FAA is limited and does not best support efforts to improve system safety, learn from diverse experiences, or optimize resources. Current oversight of the DoD air traffic system does not ensure consistent performance or safety as effectively as it could and does not provide assurance that degradation of system safety will be identified early. In order for the Department of Defense air traffic system to most effectively identify hazards early and seek continuous system improvement, a centralized, risk management based approach to safety that views the individual service communities as a single system must be adopted.

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JOINT AIR TRAFFIC CONTROL:

AN OPERATIONAL RISK MANAGEMENT APPROACH (U)

by

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An Advanced Research Project

A paper submitted to the Director of the Advanced Research Department in the Center for Naval Warfare Studies in partial satisfaction of the requirements for the Master of Arts Degree in National Security and Strategic Studies.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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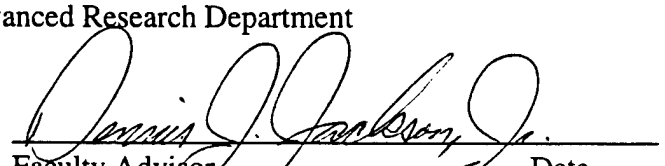

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ABBREVIATIONS

AAT--FAA Office of Air Traffic Evaluations and Investigations
A/C--Air Carrier
AAL--FAA Alaskan Region
ACE--FAA Central Region
AEA--FAA Eastern Region
AFCC--Air Force Communications Command
AGL--FAA Great Lakes Region
ANE--FAA New England Region
ANM--FAA Northwest Mountain Region
AOB--Airfield Operations Board (USAF)
AOF/CC--Airfield Operations Flight Commander (USAF)
ANOVA--Analysis of Varience Program (FAA)
AOSE--Airfield Operations Standardization Evaluation (USAF)
ARAC--Army Radar Approach Control
ARTCC--Air Route Traffic Control Center
ASO--FAA Southern Region
ASW--FAA Southwest Region
ATC--Air Traffic Control
ATCS--Air Traffic Control Specialist
ATCT--Air Traffic Control Tower
ATREP--FAA Air Traffic Representative
ATS--Air Traffic Service
ATSA--Air Traffic System Analysis (USAF)
ATSEP--Air Traffic System Evaluation Program (USAF)
ATTE--Air Traffic Team Enhancement Program (FAA)
AWP--FAA Western-Pacific Region
BASH--Bird/Aircraft Strike Hazard
CMC--Commandant of the Marine Corps
CNO--Chief of Naval Operations
CONUS--Continental United States
CRM--Crew resource management
CSE--USAF Air Traffic Chief of Standardization and Evaluation
CTO--Control Tower Operator
DoD--Department of Defense
DoT--Department of Transportation
FAA--Federal Aviation Administration
FAR--Federal Aviation Regulation
FSS--Flight Service Station
FMFM--Fleet Marine Force Manual
GATM--Global Air Traffic Management
GCA--Ground Controlled Approach
GPS--Global Positioning System

HATR--USAF Hazardous Air Traffic Report
HFACS--Human Factors Analysis and Classification System
ICAO--International Civil Aviation Organization
IFR--Instrument Flight Rules
IG--Inspector General
LOA--Letter of Agreement
MACA--USAF Program for Midair Collision Avoidance
MACOM--Major Command (Army)
MAJCOM--Major Command (USAF)
MOA--Memorandum of Agreement
MOU--Memorandum of Understanding
NAS--National Airspace System
NAVAID--Navigation Aids
NMAC--Near Midair Collision
NTSB--National Transportation Safety Board
OE/D--Operational Errors and Deviations
OHR--Operational Hazard Report (Army)
ORM--Operational Risk Management
OPR--Office of Primary Responsibility (USAF)
PBFA--Policy Board on Federal Aviation
PD--Pilot Deviation
QA--Quality Assurance
RAPCON--Radar Approach Control Facility Associated with the United States Air Force
RATCF--Radar Air Traffic Control Facility Associated with the United States Navy
SUA--Special Use Airspace
TERPS--Terminal Instrument Procedures
TRACON--Terminal Radar Approach Control
TYCOM--Type Commander (USN)
USAF--United States Air Force
USAASA--U.S. Army Aeronautical Services Agency
USAATCA--U.S. Army Air Traffic Control Activity
USAFFSA--U.S. Air Force Flight Standards Agency
USMC--United States Marine Corps
USN--United States Navy
VPD--Vehicle/Pedestrian Deviation
VFR--Visual Flight Rules

GLOSSARY

Accident. An "aircraft accident" is defined by the National Transportation Safety Board as "an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until all such persons have disembarked, and in which any person suffers death or serious injury as a result of being in or upon the aircraft or by direct contact with the aircraft or anything attached thereto, or in which the aircraft receives substantial damage."

Air Carrier. Any air operator operating under PAR Parts 121, 127, or 135.

Air Route Traffic Control Center (ARTCC). A facility established to provide air traffic control services to aircraft operating o IFR flight plans within controlled airspace and principally during the en route phase of flight. When equipment capabilities and work load permit, certain advisory/assistance service may be provided to VFR aircraft.

Air Traffic Control Tower (ATCT). A facility established to provide air traffic control services to aircraft operating on or around an airport, directing the landing and take-off of airplanes and controlling the ground traffic as well.

ATCS Examiner. An examiner designated by the facility chief or appropriate military authority for the purpose of administering ATCS ratings and performing the inherent administrative functions of such designation.

CTO Examiner. An individual designated by the Regional Air Traffic Control Examiner as a Control Tower Operator Examiner for the purpose of administering the CTO written and Facility Rating tests and performing certain administrative functions as specified in this handbook.

Flight Plan. Specified information relating to the intended flight of an aircraft that is filed orally or in writing with a FSS or an ATC facility.

Flight Service Station (FSS). Facilities that are part of the air traffic system but do not control air traffic; they process flight plans and provide information about terrain, pre-flight and in-flight weather information, suggested routes, altitudes, indications of turbulence, icing, and any other information important to the safety of flight.

General Aviation. That portion of civil aviation which encompasses all facets of aviation except air carriers.

Instrument Flight Rules (IFR). Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan.

Near Midair Collision. An incident associated with the operation of an aircraft in which a possibility of collision occurs as a result of proximity of less than 500 feet to another aircraft, or a report is received from a pilot or flight crew stating that a collision hazard existed between two or more aircraft.

Operational Deviation. An occurrence where applicable separation minima as referenced in the operational error definition below were maintained but (1) less than the applicable separation minima existed between an aircraft and protected airspace without prior approval, (2) an aircraft penetrated airspace that was delegated to another position of operation or another facility without prior coordination and approval, (3) an aircraft penetrated airspace that was delegated to another position of operation or another facility at an altitude or route contrary to the altitude or route requested and approved in direct coordination or as specified in a Letter of Agreement, pre-coordination or internal procedure, (4) an aircraft, vehicle, or personnel encroached upon a landing area that was delegated to another position of operation without prior coordination and approval.

Operational Error. An occurrence attributable to an element of the air traffic control which: 1. Results in less than the applicable separation minima between two or more aircraft, or between an aircraft and terrain or obstacles and obstructions as required by Handbook 7110.65 and supplemental instructions. Obstacles include: vehicles/equipment/personnel on runways; or 2. Aircraft lands or departs on a runway closed to aircraft operations after receiving air traffic authorization.

Pilot Deviation. The actions of a pilot that result in the violation of a Federal Aviation Regulation or a North American Aerospace Defense Command (NORAD) Air Defense Identification Zone (ADIZ) tolerance.

Radar Flight Following. The observation of the progress of radar identified aircraft, whose primary navigation is being provided by the pilot, wherein the controller retains and correlates the aircraft identity within the appropriate target or target symbol displayed on the radar scope.

Runway Incursion. Any occurrence at an airport that involves an aircraft, person, or object on the ground that creates a collision hazard or results in loss of separation with an aircraft taking off, intending to take off, landing or intending to land.

Special Use Airspace (SUA). Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature, and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. Types of Special Use Airspace:

a. Alert Area
b. Military Operations Area
c. Prohibited Area
d. Controlled Firing Area
e. Restricted Area
f. Warning Area

Terminal Radar Approach Control (TRACON). A Federal Aviation Administration (FAA) air traffic control facility using radar and air/ground communications to provide approach control services to aircraft arriving, departing, or transiting the airspace controlled by the facility. Service may be provided to both civil and military airports. A TRACON is similar to a RAPCON (USAF), a RATCF (USN), and an ARAC (Army).

Visual Flight Rules (VFR). Rules that govern the procedures for conducting flight under visual conditions. The term "VFR" is also used in the United States to indicate weather conditions that are equal to or greater than the minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

Joint Air Traffic Control: An Operational Risk Management Approach

EXECUTIVE SUMMARY

All communities within DoD have accommodated change brought about by budget cuts, the drawdown, and the emerging global security environment. For the military air traffic community, however, this environment is particularly problematic due to increases in its dual missions of providing nearly one-fifth of all air traffic services in the National Airspace System (NAS) and supporting military readiness as a major component in the force training and sustainment base. Several individual service air traffic systems have experienced problems that became systemic before being identified and addressed, indicating that system checks and balances may be inadequate to identify problems early and effectively deal with change. Current oversight in the majority of the DoD system does not ensure consistent system performance, does not provide assurance that system degradation will be identified early, and does not seek continuous system improvement. In order for the military air traffic system to develop a more proactive approach that can best ensure system functioning, a centralized, risk management based oversight strategy that views the individual service communities as a single system must be adopted.

The Military System in the NAS. DoD operates the second largest air traffic system in the world and provides service to civil aircraft at over 250 airfields and 20 joint use (military and civil) airfields in addition to military airfields. Military facilities are an integral facet of the armed forces' sustainment base by training the military controller workforce and providing flexible air traffic services and airspace management to accommodate special military requirements. The role of military air traffic control, both at fixed-bases and deployed world-wide, will most likely continue to expand as the volume of domestic and international air traffic steadily increases.

Oversight Strategies. A centralized strategy is the most effective strategy to ensure standardization in performance and safety in an air traffic system by providing a vantagepoint that can oversee the entire air traffic system and best identify problems early. The effectiveness of this strategy is seen by the FAA and Air Force air traffic systems both adopting centralized strategies to better manage their systems; both developed systemic problems under decentralized strategies. Decentralized strategies have also proven ineffective for both the Army and Marine Corps air traffic systems; both recently developing serious, systemic problems that degraded both safety and combat effectiveness under decentralized strategies. Although these services have not yet adopted centralized oversight strategies, both indicate that they intend to adopt or move toward more centralized approaches.

FAA Oversight of the NAS. Oversight of the FAA air traffic system provides the industry standard; as the basic means to ensure safety and system functioning in the NAS, this model is also applicable to military facilities in the NAS. Oversight of the air traffic system by the FAA is highly centralized in the Office of Investigations and Evaluations whose line of authority extends directly to the Director of Air Traffic. By removing the oversight process from the rest of the system and working directly for the Director, this provides timely feedback of

system performance, process objectivity, and program emphasis. Mechanisms for system oversight include the Air Traffic Evaluation Program, the Air Traffic Quality Assurance Program, and continuous assessment of system performance by the Office of System Safety; all of these elements of the oversight process are centralized at the national level. The FAA has given oversight to DoD for the military air traffic system, with only a few exceptions. The FAA neither assesses nor requires accountability for the performance of the DoD air traffic system.

DoD Oversight Strategies. Each US armed service is responsible for ensuring that its own air traffic facilities are properly staffed, equipped, and managed; there is no central oversight authority for DoD. The individual service oversight processes are not standardized and are not assessed for effectiveness by an external source. Four areas are examined below to determine the degree that each system is currently proactive: process centralization, compliance mechanisms (inspections), routine analysis of safety data, and quality assurance programs.

Process centralization. This determination is based upon the level of detail found in service directives, the level of involvement of the service's executive agency in oversight processes, and the degree of accountability required to the service level. The Air Force promulgates detailed service level directives specifying oversight processes and accountability to the service level for routine system performance; the executive agency is directly involved in the oversight process. Service directives decentralize oversight to major subordinate commands in the Naval services; the executive agency is not routinely involved in and does not assess the oversight process. Army directives are not explicit regarding oversight processes and, although there is a centralized mission area proponent, a 1996 study assessed the organizational command and control of the mission area as ineffective.

Compliance mechanisms. All services use biennial inspections of air traffic facilities as the primary means to ensure compliance with standards. Like other aspects of oversight, centralizing this mechanism has proven to be the most effective approach. The Army air traffic facility inspection process is physically centralized with one inspection team as part of the mission area proponent, however, the process does not effectively require accountability or resolve problems. Results of Army facility inspections are not centrally analyzed to discern service-wide trends. The Navy and Marine Corps have delegated the inspection process to major subordinate commands; the service level does not assess inspection results service-wide. Service directives do not provide a standardized process service-wide and the executive agencies do not assess the effectiveness of subordinate command programs. The Air Force has a centralized process with the executive agency overseeing conduct of inspections, assessing results, ensuring problem resolution, and participating in inspections.

Routine system analysis. Only the Air Force's executive agency requires and conducts routine statistical analysis of all system safety indicators. The importance placed on this is seen by general officer review of quarterly and annual reports at both the major command and service levels. In the other services, system data is not comprehensively compiled in one agency and system performance is not qualitatively assessed. The safety centers do not

compile all system indicators currently and do not conduct routine system analysis to derive trends.

Preventive Safety Programs. The Air Force has a detailed quality assurance program that requires communication between all levels and provides a methodology for continuous process improvement. Even though the Naval services have some QA type requirements, neither they nor the Army have programs that actively engage all system elements to improve communication and build safe practices.

Information Sharing. Several recent DoD, governmental, and aviation industry initiatives that aggressively seek to improve the aviation environment all stress that sharing safety information is key to reaching this goal—initiatives include the White House Commission on Aviation Safety and the National Civil Aviation Review. Currently, sharing safety data and information between the services is limited and not routine. Problems experienced by the Air Force prior to reorganization bear striking resemblance to those currently being experienced by the Army and Marine Corps, illustrating the benefit of learning from each other's successes and failures. Several initiatives within DoD to improve aviation safety such as a human factors analysis methodology developed by the Naval Safety Center and a risk management database developed by the Army Safety Center have not included ATC. Interagency information sharing between DoD and the FAA is also limited; neither safety data nor training opportunities are routinely shared throughout DoD.

Analysis. Four conclusions are drawn :

1. The most effective oversight approach for air traffic systems, whether civil or military, utilizes a risk management based strategy.

2. An effective risk management strategy is centralized, proactive, and shares safety information.

3. Risk management is not effectively incorporated in the military air traffic system since only one armed service substantively applies risk management.

4. DoD needs to incorporate risk management into air traffic oversight in a joint, systems approach.

The bottom line. The armed services face a difficult environment as they attempt to balance diminishing resources with growing missions. Regardless of the pressures at any particular time, mechanisms to ensure consistent performance and safety in the air traffic system should be rigorous and seek continuous improvement. This not only makes sense, but it is also DoD policy as articulated in the operational risk management programs. The mechanisms are not consistently in place throughout the DoD air traffic system currently to detect developing problems or to seek continuous system improvement. Oversight is not centralized—either at the DoD level or within three armed services. Most of the services do not conduct routine analysis of system indicators and air traffic has not consistently been an area of emphasis for the safety centers. Sharing of information between the services and with the FAA is limited

and does not best support efforts to improve aviation, learn from diverse experiences, or optimize resources. Additionally, routine opportunities for the military air traffic system to work and train together as a joint community are being missed.

The degree of safety in the military system cannot be effectively determined at this point due to the lack of aggregate data and analysis. What can be identified, however, is that the current safety regulatory structures for the armed services' air traffic control communities are not as effective as they could be and that opportunities to provide greater assurance of safety, realize efficiencies, and improve readiness are not being fully exploited. Recommendations to this end are offered below.

Recommendations.

1. Joint ATC Oversight and Risk Management Strategy. Adopt a standardized, risk management based, oversight strategy to facilitate information sharing, ensure the highest level of safety possible, and promote continuous system improvement throughout the DoD ATC system. In order to do this, the Secretary of Defense should require safety oversight of all military air traffic facilities be managed as a single system and develop a strategy to ensure consistent, proactive system regulation. This strategy should be based upon the Air Force model and should consider the following:

- Establish a joint forum or staff to develop a risk based strategy and conduct continuous oversight of the military air traffic system.
- Provide adequate staffing at Safety Centers to support more proactive oversight.
- Establish a joint safety database for ATC.
- Develop a joint incident reporting format to support joint database.
- Assess the suitability of incorporating ATC into the human factors initiative at Naval Safety Center.
- Conduct an annual assessment of military air traffic system.

2. Establish an Interagency Air Traffic Safety Partnership. Although there are many ties regarding air traffic between the FAA and DoD, none routinely share safety information in a real time, operationally focused manner. In order to most effectively comply with the public law, optimize resources and mutually benefit from both agencies' experiences, the Secretary of Defense should initiate a safety partnership with the FAA. This will strengthen the interagency relationship and provide greater focus on safety and continuous improvement through operational interface of the safety regulatory mechanisms. This partnership should include:

- Sharing the annual assessment of the military system with the FAA.

- Rewriting the 1969 interagency MOU to include the safety partnership.

- Assign military air traffic specialists to work in the oversight process at FAA Headquarters to develop and implement the joint strategy and build the safety partnership (i.e. work in the Office of Air Traffic Evaluations and Investigations where no military reimbursables are currently assigned).

3. Assessment of current status of military air traffic control. This research is limited in scope and does not definitively assess current system functioning and safety. However, several concerns raised in this research indicate that further assessment to determine the status of the military air traffic control and the adequacy of oversight processes could be of significant benefit. A comprehensive evaluation of all DoD air traffic control systems should be conducted to determine if there are safety issues that require intervention and to establish a baseline prior to undertaking joint initiatives.

CHAPTER 1

INTRODUCTION

All communities within the Department of Defense are wrestling to accommodate the changes brought about by budget cuts, the drawdown, and the emerging global security environment. For the military air traffic community, this environment is particularly problematic due to its unique dual mission of serving both the public interest as an integral part of the National Airspace System and supporting military readiness as a critical component of the force training and sustainment base. Not only are these dual missions demanding, but they are both increasing in an environment made more turbulent by aging equipment, controller shortages, and the beginning of a major system transition from a ground based to a satellite based air traffic system. As system volume steadily rises both domestically and internationally, the demand for air traffic services deployed to support operations other than war (OOTW) has also increased.[1]

The Department of Defense runs the second largest air traffic control system in the world, providing approximately one-fifth of all services in the National Airspace System (NAS). Although the Administrator of the FAA is ultimately accountable for the entire air traffic system in the National Airspace System, responsibility for the performance and safety of the military air traffic system has been almost entirely delegated to DOD to enable it to best meet its unique requirements. Oversight within DoD is decentralized with each service tracking and assessing their own facilities; three of four services (Coast Guard ATC is provided by DOT and is excluded in this assessment) have further delegated significant portions of system oversight to major subordinate commands. Safety related

data and information are not shared as effectively as possible between the services and analysis cannot be accomplished to determine if trends are developing across the services.[2]

The result is that the military air traffic system is managed as four separate systems—each with its own approach to oversight—and not as a single system.[3] Oversight is decentralized further within some services and analysis of safety data to discern trends and identify hazards is not consistently conducted. The approach to managing safety within the DoD air traffic system is largely reactive and this approach is not consistent with either DoD or individual service operational risk management policy that attempts to make systems proactive.

As the services grapple to adjust resources and priorities to continue to adequately support both missions, are the existing checks and balances of the military air traffic system adequate to ensure that system performance and safety remain at acceptable levels both now and in the future? Current oversight of the DoD air traffic system does not ensure consistent performance and safety as effectively as it could and does not provide assurance that if air operations gradually become less safe that this will be readily identified. In order for the Department of Defense air traffic system to most effectively identify hazards early and seek continuous system improvement, a centralized, risk management based approach to safety that views the individual service communities as a single system must be adopted.

The National Airspace System

The military air traffic system is an integral part of the overarching federal system, the National Airspace System (NAS), that provides for the needs of all airspace users in

the US--civil and military. Before an assessment of the military air traffic system can be accomplished, an examination of this complex system and how the military air traffic system is imbedded within it is required.

Origins of the NAS

The air traffic system in the United States has military origins and was, in fact, principally a military system until 1938 when air commerce began to grow exponentially. The Civil Aviation Authority was established to promote air commerce in 1938, promoting and maintaining civil aviation separately from military aviation. In 1958, recognition that system volume and complexity required better integration of system users resulted in the Federal Aviation Act (FAA) of 1958. From the outset, the language of this law specifically addresses military requirements--

> An Act
>
> To continue the Civil Aeronautics Board as an agency of the United States, to create a Federal Aviation Agency, to provide for the regulation and promotion of civil aviation in such manner as to best foster its development and safety, and to provide for the safe and efficient use of the airspace by both civil and military aircraft.[4]

The FAA Act of 1958 was very clear and specific in establishing the Administrator of the FAA as the single regulatory authority for administration and oversight of the sovereign airspace of the United States. The following passage illustrates the emphasis of the law in charging the Administrator to ensure that military requirements were met and that the civil air traffic system would fully embrace the military system:

Declaration of Policy: The Administrator

> In the exercise and performance of his powers and duties under this act *the administrator* shall consider the following...as being in the public interest:
>
> a. The regulation of air commerce in such a manner as to best promote its development and safety and fulfill the requirements of national defense;
>
> c. The control of navigable airspace of the United States and the *regulation of both civil and military operations* in such airspace in the interest of the safety and efficiency of both;
>
> e. The development and operation of a *common system of air traffic control* and navigation *for both military and civil aircraft*. [my emphasis][5]

The Administrator of the FAA was specifically charged to both provide a common system of air traffic control and then to regulate it. The FAA Administrator still retains responsibility for the safety and functioning of both the civil and military components of the air traffic system.

The NAS Today

The air traffic control system in the NAS is a highly complex, interrelated set of systems--systems that fly, surveillance systems, navigation systems, communication systems, automation processing systems--all operated by the "human system." Air traffic facilities collectively compose the air traffic system, pulling these subsystems together to manage the air traffic within the NAS. The FAA operates the largest air traffic system in the world, operating over 400 Air Traffic Control Towers (ATCTs), over 75 Flight Service Stations (FSSs), 185 Terminal Radar Approach Controls (TRACONs), and 21 Air Route Traffic Control Centers (ARTCCs). These facilities handle approximately 140 million aircraft operations annually.

By the year 2010, the number of U.S. domestic aviation passengers will double and

the number of commuter/regional passengers will triple, totaling over one billion passengers carried in one year.[6] Airline inventories will increase by 50% and will include larger, heavier aircraft; the size of regional commuter fleets will double and include a greater percentage of sophisticated aircraft. Although not growing at a rate as exponential as the commercial sector, the general aviation fleet is expected to grow steadily at a 9% rate during this same period.[7] The global nature of the aviation environment is projected to accelerate during the next two decades and sharp increases in international aviation are expected. In addition to increasing volume, other factors will also make the operating environment more difficult: the diversity of aircraft, changing technology, and globalization of the airline industry, aging air traffic equipment, and shortages of controllers.[8] In this environment of substantial growth and change, the air traffic system must transform from a ground based to satellite based system over the next 20 years as the Global Air Traffic Management (GATM) initiative implements the concept of free flight. From virtually any perspective, the air traffic environment is complex and will become more, not less, complex in the future.

The Military Air Traffic System in the NAS

In order for the Department of Defense to obtain airspace for its own use, the FAA must delegate it. A 1969 Memorandum of Understanding between the military departments and the FAA provides airspace for military facilities if delegation will be mutually advantageous. Military air traffic facilities handle all civil as well as military air traffic and must provide the same service as an FAA facility to ensure consistency throughout the National Airspace System.

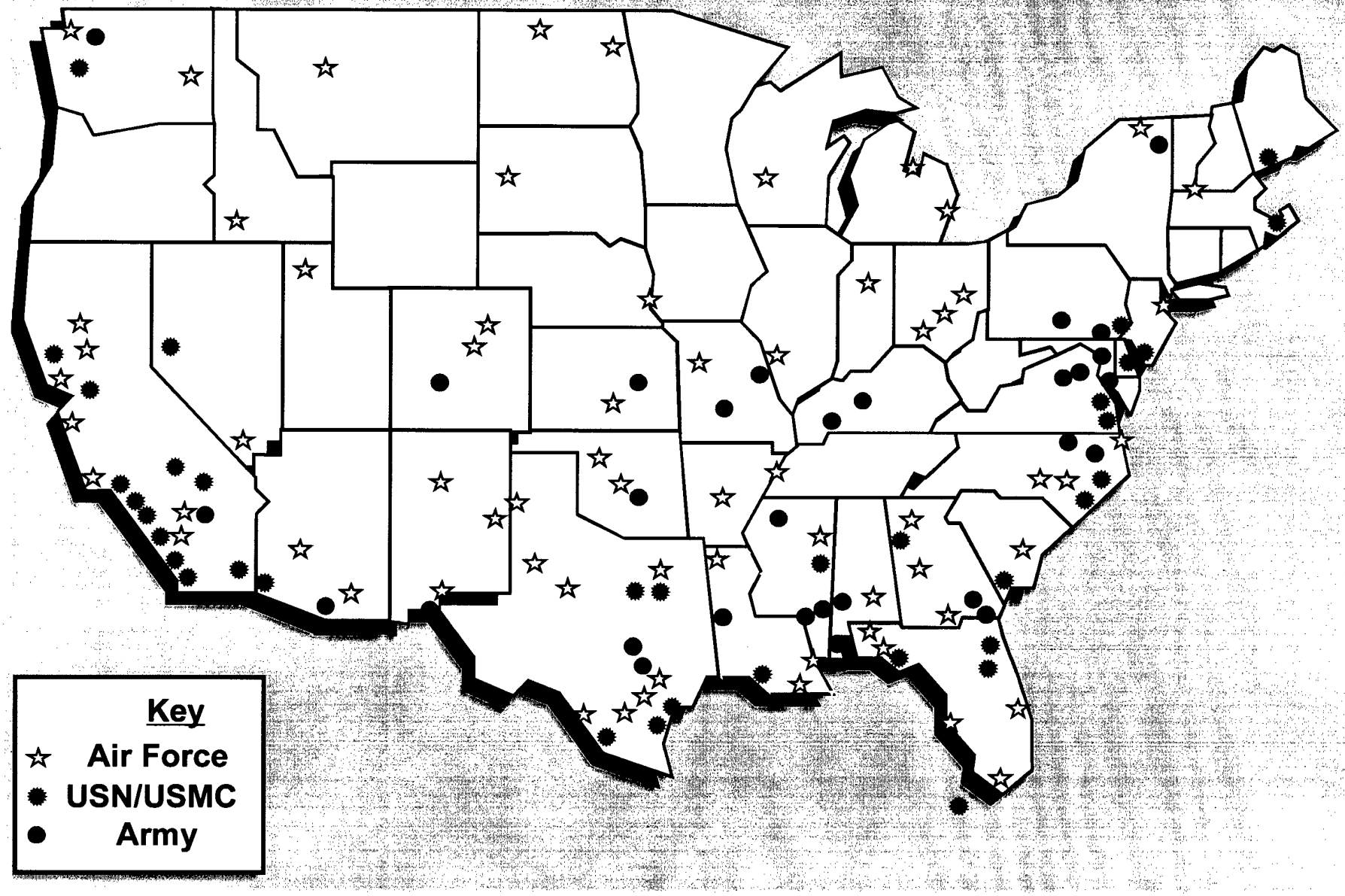
Today, 254 military air traffic facilities provide nearly one-fifth of all air traffic services provided in the National Airspace System and constitute the second largest air traffic system in the world. Military air traffic facilities provide service to commercial and private aircraft at over 250 civil airfields in the United States and 20 joint use (i.e., both military and civil aircraft) airfields in addition to services at exclusively military airfields.[9] The amount of civil traffic handled by service varies between 10 and 30%.

Many military facilities are large and complex; sixty-three military facilities are radar approach controls and five facilities provide en route services in the NAS.[10] Figure 1 illustrates the general location and distribution of military air traffic facilities in the continental United States (CONUS); note the density of military facilities in both the east coast and southern California coasts, among the busiest and most complex air traffic corridors. Although the U.S. Air Force has the most facilities, every service has facilities with moderate to high volume and complexity that substantively impact the National Airspace System.

The Dual Role of Military Air Traffic Control

Military air traffic control facilities have a dual purpose; they support combat readiness as an integral part of the force training and sustainment base in addition to serving the public interest as a significant portion of the National Airspace System. Military air traffic facilities acquire, control, and manage airspace not only for aircraft movement but also airspace specifically designed for military training: Special Use Airspace. This airspace segregates military operations considered hazardous to nonparticipants and provides airspace associated with military training ranges--whether

Figure 1. Military Air Traffic Control Facilities in the National Airspace System (CONUS)



ground, air, or sea. Tanks, artillery, and small arms depend upon this airspace for training as well as the aviation communities. Figure 2 illustrates the significant amount of Special Use Airspace that is managed by the U.S. armed services.[11]

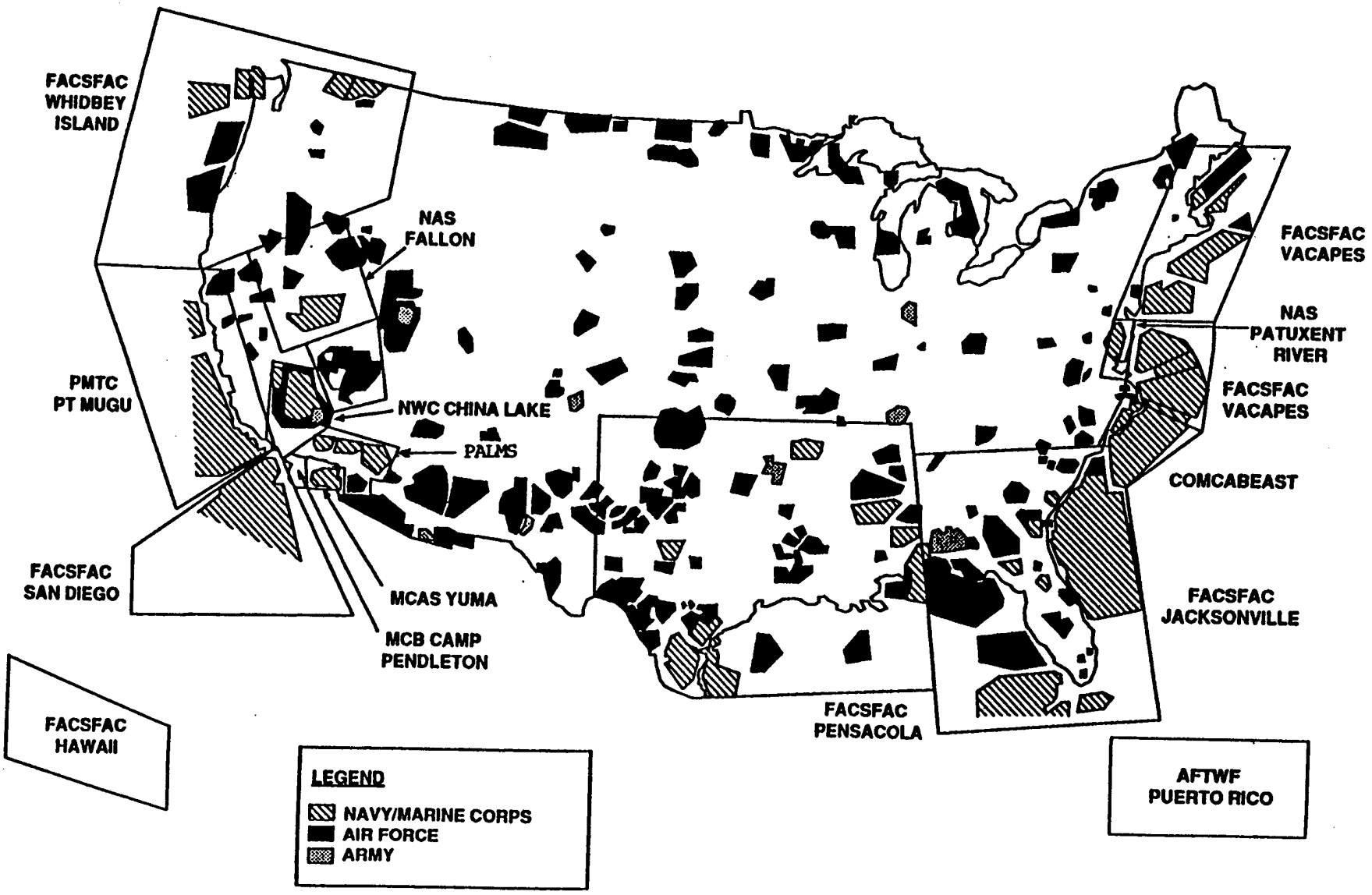
Military air traffic facilities are also the training ground where military controllers obtain the combat skills that they need to provide air traffic services or to serve as liaisons with international agencies while deployed. The demand for air traffic support has increased and will most likely continue to increase as long as the United States is actively involved around the world. Air traffic internationally is increasing at rates even faster than those in the domestic airspace of the United States and many international systems are ill prepared to deal with these increases. Regions such as the Pacific Rim, Africa, and Asia have experienced annual increases in traffic volume of up to 120%, yet have air carrier accident rates up to ten times that of other regions.[12]

In an increasingly complex and difficult global aviation environment, a highly skilled, professional controller workforce--although numerically small within DoD--is necessary to protect and maintain U.S. strategic interests. The fixed-base, military air traffic facilities in the NAS are the breeding ground for this workforce. The role of military air traffic, both at fixed-bases facilities and deployed world-wide, is critical and will most likely continue to expand as the volume of domestic and international air traffic steadily increases.

This paper will compare centralized and decentralized air traffic system oversight strategies and their applicability for the DoD air traffic system. This assessment also seeks specifically to determine which strategy best supports an operational risk management approach to oversight. The FAA's approach to oversight will be examined

to determine if it has applicability as a benchmark for comparison with DoD's current approach. The air traffic safety regulatory structures for the four DoD systems will then be examined to determine if they are adequate to rigorously ensure system performance and safety and if they incorporate operational risk management. Finally, recommendations to make the existing safety regulatory structures more rigorous and proactive will be offered.

Figure 2: Military Special Use Airspace



CHAPTER 2

STRATEGIES FOR AIR TRAFFIC SAFETY OVERSIGHT

Standardization--in performance, system assessment, and problem resolution--is a basic tenant in achieving safety and efficiency in air traffic control. From the concept of a "common system" specifically articulated in the public law to being a common thread throughout training and procedures; standardization is clearly part of the foundation of an effective air traffic system. Standardization is so central to flight safety that it was identified by Secretary of Transportation James Burnley as one of his "five criteria" for FAA reform, requiring the proposal ensure "...consistency in both safety regulation and in the delivery of air traffic control services..."[13] In a complex system with little room for interpretation of standards, a centralized oversight strategy is the most effective way to achieve rigorous air traffic system standardization as evidenced by recent reorganizations in both the FAA and DoD that are discussed below.

Three models are presented to illustrate that a centralized strategy is the most effective for oversight of an air traffic system. The FAA and the U.S. Air Force are utilized for this purpose since they offer insight from their transformations from decentralized to centralized strategies; the U.S. Army strategy is also examined since it has identified the need for a centralized organizational structure. The oversight strategies of the other armed services will be examined later in Chapter 4. Operational risk management (ORM) is the method that the armed services have adopted to control and reduce the risks associated with military training and operations. The applicability of ORM for incorporation into an air traffic oversight strategy will be discussed; this chapter

further argues that since a centralized strategy comprehensively assesses all aspects of an air traffic system it is, therefore, the most effective strategy to incorporate ORM.

A Centralized Approach to Oversight

The Aviation Safety Commission Act of 1988

Public interest in the safety of the air system increased after the Airline Deregulation Act of 1978 led to an expansion in the number of airlines, acquisitions and mergers. The magnitude of growth in the air transport industry following deregulation brought about an unprecedented level of public uneasiness with the ability of the system to cope with these changes and ensure safety. This concern was formally acknowledged for the first time with the passing of the Aviation Safety Commission Act of 1986, requiring that a study determine whether the existing organization and functions of the Federal Aviation Commission (FAA) were effective in ensuring aviation safety.[14]

The Aviation Safety Commission Study concluded that the nation's air transportation system was safe. In a comparison of a nine-year period prior to deregulation (1970-1978) and a nine-year period following deregulation (1979-1987), the number of passenger fatalities decreased after deregulation despite a 55% increase in passenger enplanements and a 26.5% increase in aircraft departures.[15] The commission also concluded, however, that the existing aviation safety regulatory structure was inadequate to deal with future growth and technological change, attributing this to its "...diffused authority and accountability..."[16]

The commission noted that maintaining certain aspects of the safety regulatory structure at the regional level instead of the national level had led to inconsistent

interpretation of safety regulation across regions, such as the air carrier certification process. The report indicated that a more centralized, national certification program would "...introduce greater uniformity of regulations, standards, and enforcement and make the safety oversight function more effective..." [17] Similarly, the commission felt that local air carrier inspection programs should be replaced with a national inspection program to produce greater uniformity in enforcement, avoid complacency, and facilitate learning from the varying experiences throughout the system.[18]

While the commission did not specifically address the need for the air traffic system to have centralized oversight, they referred to the system's inability to consistently ensure parity in controller staffing levels between regions; manpower shortages in some regions were allowed to become so significant as to be described by the commission as having "...potential safety implications..."[19] The commission also specifically articulated the importance of consistency in air traffic oversight and service delivery.[20] The very formation of the Aviation Safety Commission reflected the increasing demand for accountability of system safety and that the public now demanded that every effort be made to identify underlying problems and resolve them before they were manifested in loss of life and property.

Reorganization within the FAA

Within months of the Aviation Safety Commission's final report publication, the National Transportation Safety Board (NTSB) began a series of special investigations to examine a rash of aviation incidents involving controllers during 1988 and 1989. In three separate NTSB reports, concern for adequate oversight of the air traffic system was

expressed even more clearly. The Chicago O'Hare air traffic facility (terminal radar approach control and tower) had 19 operational errors between January 1 and June 7, 1988.[21] Despite O'Hare's operational error rate[22]climbing much higher than that of other ATC facilities with comparable traffic--four times that of Atlanta, five times that of Los Angeles, and three times that of Dallas-Ft. Worth--the FAA's national quality assurance program "...did not respond...aggressively to this dramatic increase in operational errors."[23] The Safety Board was particularly concerned that the FAA national air traffic quality assurance and safety staff did not initiate either comprehensive investigations or make recommendations to reduce the number of operational errors at O'Hare, but left remedial action solely to the discretion of the facility manager.[24] The Safety Board felt that the FAA's oversight of the air traffic system was reactive and explicitly voiced this concern:

> The Safety Board is concerned that the FAA has no system to monitor the safety performance of the ATC system, and where appropriate, detect a sudden increase in operational errors at a specific facility...without this system surveillance, the FAA lacks a proactive quality assurance program. Therefore, the Safety Board believes that the FAA should establish a system to monitor the total ATC system to detect significant increases in operational errors and other system deficiencies and initiate appropriate investigative and preventive actions.[25]

Not only did the Safety Board recommend that the FAA adopt a proactive ATC regulatory structure, but it also recommended an independent mechanism to ensure compliance--a national air traffic quality assurance program that was directly accountable to the Administrator.[26]

The O'Hare investigation was soon followed by two other NTSB special investigations in 1989 that focused on incidents involving air traffic control. The first

incident was an operational error on 13 February 1989 between a British Airways flight, a Boeing 747, and an American Airlines flight, a British Aerospace 146, that involved three FAA air traffic facilities. The second incident occurred on 8 September 1989 when a US Air flight, a Boeing 737-200, severed four electronic transmission cables while executing a localizer approach at Kansas City, Missouri; the cables were 75 feet above the ground and approximately 7,000 feet east of the runway threshold. In both investigations, the Safety Board discovered myriad underlying problems that had either been identified and not addressed or had not been identified despite recent inspections. Having been previously critical of the FAA's safety oversight and quality assurance of the air traffic system, these incidents furthered the Board's opinion stating "The Safety Board continues to lack confidence in the FAA's commitment to provide effective quality assurance and safety oversight of the ATC system."[27]

At the Coast terminal radar approach control where the operational error occurred in southern California, a national evaluation and on-site review of the facility had been conducted after a series of eight operational errors. The Safety Board investigation identified many of the same deficiencies that the FAA report had identified; however, the FAA report did not contain recommendations for corrective action or headquarters follow-up. The Safety Board believed that the FAA's failure to address these deficiencies and problems contributed to the error and again pointed to inadequacies of the FAA's safety regulatory structure for air traffic:

> The Safety Board's special investigative team has determined, again, that FAA's quality assurance and safety oversight of the ATC system, as administered by the Air Traffic Service, is inadequate and ineffective. FAA documents...attest that everyone from the Facility Manager to the Administrator [e.g., of the FAA] observed the deficiencies and problems

> at Coast TRACON and reported them to all levels of air traffic management during the past three years...despite this knowledge, the Air Traffic Service and its quality assurance program has, to date, failed to address and correct the problems...The Board believes these illustrations, collectively, exemplify an inadequate, ineffective and unresponsive quality assurance and safety oversight program.[28]

Similarly, the Safety Board's report of the US Air incident in Kansas City concluded that there was "...inadequate FAA vigilance over the air traffic control system, as well as training and guidance to operations inspectors..."[29]

During this period, FAA headquarters had effectively decentralized the inspection and quality assurance programs by delegating most oversight functions to the regional level. Additionally, the NTSB reports noted that FAA oversight lacked objectivity since the enforcement mechanisms—the inspection and quality assurance programs—were a part of Air Traffic Services itself. An Office of Aviation Safety Quality Assurance was created to maintain system oversight, but not much changed initially since it was understaffed with only two air traffic specialists (ATCSs). Regional offices conducted inspections and follow-up autonomously; reporting and accountability to the national level was by exception and was initiated only when the regions desired assistance. Follow-up to ensure adequate corrective action was taken to resolve problems was not rigorous or consistent, leaving many problems unresolved.[30]

The public demand for accountability and concerns of the NTSB resulted in a reorganization that established the Office of Air Traffic Investigations and Evaluations in 1991. This office provided both centralization of system oversight and objectivity since it reported directly to the Associate Administrator of Air Traffic. Four inspection teams of 14-16 personnel each are located in Atlanta, Seattle, Dallas/Ft. Worth, and Washington

work with the regions but are directly accountable to the national level. The continuing emphasis of the FAA in promoting centralized, proactive safety oversight is seen in the promulgation of the first FAA Air Traffic Quality Assurance order in February 1998 that requires active participation at the national, regional, and facility levels to identify problems before they become incidents and to actively promote safe practices.

Identification of system performance and responsiveness in correcting deficiencies have both improved under the more centralized and proactive approach taken by the FAA as illustrated by recent actions responding to system indicators. In the fall of 1997, an upward trend was identified in the rate of operational errors/deviations (OE/D) in both en route and terminal facilities in nearly all regions.[31] Special assessment teams were directed into seven Air Route Traffic Control Centers (ARTCCs) and Terminal Radar Approach Controls (TRACONs) that were identified as having significant increases in OE/D rates.[32] Teams had representation from national and regional staffs and the field evaluations branches (i.e., inspection teams).

Findings of these special assessments were presented at an Air Traffic Management Team meeting in Washington, D.C. during January 1998. Specific goals and initiatives were directed at the national level and communication between all levels at specified intervals was required. Areas of deficiency were identified, training developed and implemented, additional analysis to further assess trends, and provisions for further sharing of lessons learned were accomplished within four months of the problem being initially identified. The manner that the system identified and reacted to system deficiencies in 1997 stands in stark contrast to that described in the NTSB reports of 1988 and 1989 and reflect an aggressive, proactive safety regulatory system. In 1997, a

systemic trend was identified, addressed, and strategies began to be implemented within a few months as compared to problems identified at many levels of management that remained unresolved for over three years in 1989.

These examples illustrate that air traffic system oversight has proven more effective for the FAA under a centralized strategy than under its previously decentralized strategy. One armed service underwent a similar reorganization in 1995 and adopted a centralized strategy that has proven more effective than the previously decentralized strategy; another service currently experiencing problems has identified a centralized organizational structure is an essential element of corrective action. An examination of these military strategies demonstrates that a centralized oversight strategy is effective for military air traffic systems also.

Reorganization with the U.S. Air Force

Prior to 1990, the Air Force air traffic system was under the centralized, operational control of the Air Force Communications Command (AFCC). Regulatory guidance was standardized and AFCC conducted detailed inspections of air traffic units. In the 1990 reorganization, AFCC was deactivated and responsibility for air traffic operations and maintenance shifted to the major commands (MAJCOMs). A significant number of officers moved into other occupational specialties to remain competitive in this new organizational environment, resulting in reduced technical expertise and experience in leadership. Reductions in the number and grade of ATC officers at the wing and MAJCOM resulted in "...decisions...pushed to a lower level and made by leaders with increasingly less experience."[33] Another impact was that "Compliance and standardization

inspections were suspended because MAJCOMs did not have experience or manning to conduct ATC inspections..."[34] Concurrently, personnel losses due to the drawdown resulted in a service-wide change that shortened regulations. Major Commands developed their own detailed instructions to "fill in the blanks" and compensate for the lack of specific guidance, resulting in a degradation of standardization between MAJCOMs.[35] Concerns from the ATC community began to be voiced regarding a lack of support and the potential for degradation of flight safety and efforts to develop an Executive Agency for the air traffic field were initiated.[36]

During this time frame, three ATC-related mishaps occurred which resulted in fatalities. In June 1992, a civilian aircraft flew into a mountain at Holloman AFB; in August 1993, two F-16s collided during a landing at Kunsan, Korea; and in March 1994, an F-16 had a well-publicized midair collision with a C-130 at Pope AFB. Following the Pope incident, the Director of Operations for the Air Force requested a thorough review of the Air Force ATC system. The effort to establish an Executive Agency for the community was accelerated, and the U.S. Air Force Flight Standards Agency (USAFFSA) was formed in 1994.

The Air Traffic Control Special Management Review (SMR) conducted by the Inspector General of the Air Force concluded the following about the air traffic field:

- shortened directives resulted in reduced standardization between Major Commands
- inspection program lacked objectivity and depth
- lack of accountability in resolving inspection discrepancies resulted in corrective action not being taken
- disparate service-wide assignment and staffing left some facilities overstaffed while some were understaffed
- training was not standardized
- training materials--especially simulators--were inadequate

- expertise and experience in ATC leadership was declining
- emphasis on the Hazardous Air Traffic Report (HATR) Program had been reduced[37]

The most sweeping change of the Air Traffic Control Special Management Review was the centralization of all aspects of system oversight in the Executive Agency, USAFFSA. USAFFSA was established as the functional manager/evaluator of ATC systems and airfield management; the Air Force ATC community now had a focal point for support, technical advice, standardization, and accountability. USAFFSA developed and implemented rigorous inspection and quality assurance programs to ensure service-wide system safety and standardization. While staffs at the Major Command level conduct the inspections, the USAFFSA staff is personally involved in inspections, maintains service-wide system oversight, and analyzes system performance.[38]

An example that demonstrates the effectiveness of the centralized oversight of the Air Force air traffic system is seen in a deficiency identified during the mishap of a Korean Airlines flight into Guam during 1997. The air traffic control facility at Guam is staffed by FAA controllers but utilizes Air Force equipment. During the mishap investigation, a system-wide software problem affecting the Minimum Safe Altitude Warning (MSAW) system was identified. USAFFSA validated the problem then directed the MAJCOMs to rectify this problem at all facilities. Within three days, software changes were completed, controllers were trained on changes, and Terminal Instrument Procedures databases feeding data into the MSAW were revalidated.[39] USAFFSA's centralized management and operational involvement readily identified a problem then took swift, comprehensive action to rectify it.

The fact that USAFFSA resembles the previously discussed approach of the

FAA's Air Traffic Evaluations branch is no accident. In an attempt to leverage off of the FAA's experience and accelerate efforts to establish an Executive Agency, the Air Force evaluated the FAA's centralized air traffic safety regulatory structure and adopted portions of if for their new program.[40] The adoption of centralized strategies for system oversight, to include safety oversight, by both the Air Force and the FAA has facilitated greater system standardization and improved problem identification and resolution better than their previously decentralized strategies.

Pending U.S. Army Reorganization

Concerns regarding the degradation of safety and readiness in the air traffic mission area prompted the U. S. Army's Assistant Deputy Chief of Staff for Operations and Plans, Force Development to request a study in 1995. The U. S. Army Force Integration Support Agency subsequently conducted a U.S. Army ATC Worldwide Organizational and Management Assessment (O&MA) study, publishing its final report in May 1996. The purpose of the study was to assess the impact of a 1986 reorganization that moved air traffic from the Information Systems Command (ISC) to the Army's Major Commands (MACOMs). This comprehensive study of over 2,000 pages revealed serious problems in both combat readiness and safety in the mission area. USAFISA's methodology requires that all issues identified in a study be resolved before the conclusion of the study, however, problems in the air traffic mission area were so extensive that they could not be resolved by either the team, installations, major commands, or the aviation proponent during the study.[41] At first the team felt that statements by air traffic personnel were exaggerations or anomalies, however, as the study progressed the team found that

they were not. Below, the team describes their surprise over the extent and serious nature of the problems facing the air traffic mission area:

> The O&MA Team, convinced the O&MA was no different than any other study, tried to deal with the issues. As the study matured and a pattern unfolded, the study team realized that these issues were not [isolated] issues, but symptoms from a functional area that was 'out of control.'[42]

The mission area proponent, the U.S. Army Air Traffic Activity (USAATCA), is responsible for the 'health' of the air traffic community but is not empowered to require compliance or to provide advocacy effectively. Installations have complete control over their respective air traffic facilities; the study describes USAATCA as "impotent" in providing oversight.[43] The study concluded that the following was the central problem contributing to mission area degradation: "There is no one organization to provide leadership with responsibility and mission accountability for the mission area guidance, supervision, and management as ATC crosses through the Army systems."[44]

The study's baseline assessment of the air traffic mission area is specific about the extent of problems in the areas of focus; although the following excerpt is lengthy, it is necessary to illustrate the pervasive nature of the team's findings:

> 7. *Core Issue.* The existing system produces an unqualified controller and maintenance workforce for warfighting and sustainment operations.
>
> a. ...current ATC decentralized system is ineffective and costly...organization is inadequate...It lacks the ability to produce trained soldiers, and has no central leadership or capability to develop leaders.
>
> b. ATC is affected by independent organizational management actions responding to competing organizational goals, split proponency doctrine, downsizing manpower, and outdated equipment.
>
> c. ..affected by reduced capability to support operations, lack of standardization, maintenance problems and inability to provide Army with fully qualified maintenance or controller soldiers.

8. *Funding.* Costs for ATC are not visible through a broken audit trail and do not support the current system.

a. Conflicting priorities within each MACOM, installation, and activity guarantee multiple systems and funding disparity for ATC organizations. This process is inherently dysfunctional...

9. *Readiness.* The existing system produces an unqualified warfighting and sustainment base workforce.

a. The current system does not train officers, warrant officers, therefore, enlisted soldiers, capped at sergeant first class (E-7), provide the leadership to field commanders...qualifications of the soldier are deteriorating and the experienced, trained 1986 era controllers are at the end of their careers. There is a projected loss of 636 controllers in the next 18 months (total 1998 on-hand strength is 1016).

b. Only 340 of the 1105 controllers hold...certifications (tactical)...only 496 have fixed based ratings...

c. Newly graduated controllers...cannot obtain a rating for lack of training opportunities...

d. Individual units do not have access to nor the ability to cross existing organizational barriers to rectify their situation.

10. *Safety.* The low percentage of fully qualified controllers and maintenance workers, staffing imbalances, inadequate doctrine, outdated equipment, organizational structural deficiencies, and lack of training opportunities, *all contribute to a degraded safety posture.*...ATC personnel at all organizational levels hesitate to report problems...

11. *Leadership.* The leader development pipeline is nonexistent...attrition will shortly remove the last vestiges of expert leadership available to Army.[45] (my emphasis)

Equally as alarming as the results of the USAFISA study is the fact that, two years after the publication of the final report, no near term strategies to provide immediate relief have been provided to the mission area--including fixed-base air traffic facilities serving as part of the National Airspace System. Two service-wide actions have been taken since the publication of the final report in May 1996: a moratorium on movement of force structure

and a message to the Major Commands stating there were "indications of problems" in the air traffic mission area and requesting a risk assessment of air traffic units.[46] Results and of the risk assessment and subsequent action taken were not compiled at the service-level.[47] The Army's largest radar approach control facility, a level IV facility, neither participated in nor was aware that a risk assessment had been conducted in the wake of the USAFISA study; the same problems that were identified to the USAFISA team still exist today.[48] Organizational structure problems identified in the USAFISA study made problem resolution almost impossible and while long term strategies are being developed, little has been done to change the state of the air traffic mission area.[49] The current problems of the Army's air traffic mission area are, unfortunately, an effective illustration of how both combat readiness and safety can be compromised without centralized oversight.

The Strategy of Decentralized Oversight

Although the preceding examples of air traffic system oversight reorganization chose a centralized strategy as the most effective for them, can a decentralized strategy be unsuitable or even damaging to mission accomplishment in some armed services? The diversity in approaches and cultures of the armed services are beneficial and aptly support their varying missions; forcing centralization of a functional area at the DoD level could be counterproductive or even detrimental. Additionally, the very philosophy of command supporting our current approach to warfighting, maneuver warfare, articulates the need for decentralized command to develop boldness and initiative in subordinates to empower them to respond independently in the uncertainty, disorder, and fluidity of battle.[50]

Is then, a centralized oversight approach for air traffic at odds with this decentralized philosophy of command? A further examination of this philosophy of command reveals that while maneuver warfare requires allowing greater latitude to subordinates, the inherent centralization of command remains a critical and valid aspect of command:

> Commanders should command from where they can best influence the action, normally well forward. This allows them to see and sense firsthand the ebb and flow of combat, to gain an intuitive appreciation for the situation that they cannot obtain from reports. It allows them to exert personal influence at decisive points during the action...to locate closer to the events that will influence the situation so that they can observe them directly and circumvent the delays and inaccuracies that result from passing information up the chain of command.[51]

FMFM 1 goes as far as to explicitly dismiss this level of involvement by the commander as intrusive or detrimental—what might currently be termed as micromanagement--by saying "*We must remember that command from the front does not equate to oversupervision of subordinates.*"[52] [emphasis in the original] Therefore, an inherent tension exists between the requirement to allow subordinates freedom in order to develop initiative and the need for commanders to maintain the level of awareness required to provide influence when necessary. It is difficult to reconcile this tension in the air traffic control community since the inevitable mistakes made in the learning process are more than an inconvenience and can directly degrade the safety of the flying environment; costs can quickly overcome the benefits. A baseline of safety must be maintained or both military readiness and our obligation to adequately serve the public interest will be degraded.

It is advantageous to retain service individualism and freedom in many areas, but provision of basic air traffic services can be negatively impacted by the differences

wrought by individualism. System safety—whether the system is a civil or military one---- can be assured most effectively if a single agency has oversight. While decentralization of many functions can promote military readiness, decentralizing the safety regulatory mechanism for air traffic can actually serve to degrade readiness.

A Risk Management Based Safety Strategy

The convening of the Aviation Safety Commission of 1988 marks the beginning of a movement that demanded and has continued to demand that the system seek the highest level of safety possible. Essentially, this movement seeks a system that is proactive with regard to safety--one that identifies hazards and addresses them before they result in catastrophes--the very essence of a risk management based strategy.

The aggressive response to this demand is evidenced by the FAA's strategic safety goal of Zero Accidents and the 1997 White House Commission on Aviation Safety's equally ambitious goal of reducing the aviation fatal accident rate by a factor of five within ten years.[53] Similarly, the Department of Defense has also recently undertaken an aggressive, proactive safety initiative that seeks to more effectively reduce risks—the Operational Risk Management (ORM) initiative.

Risk management in DoD is not a radical new way of doing business; a risk management philosophy and methods have been used both intuitively and experientially for years. However, the current environment of increased visibility and reduced resources makes formal recognition of the need to balance costs and benefits more critical now than ever before. Operational risk management (ORM) simply uses a systematic method rather than relying solely on experience to ensure this is done thoroughly and consistently.[54]

ORM contributes to mission success as the following excerpt from the Naval services' policy statement attests:

> Uncertainty and risk are inherent in the nature of military action. The success of the Naval Services is based upon a willingness to balance risk with opportunity in taking the bold and decisive action necessary to triumph in battle. At the same time, Commanders have a fundamental responsibility to safeguard highly valued personnel and materiel resources, and to accept only the minimal level of risk necessary to accomplish an assigned mission.[55]

Each service has formally promulgated ORM policy requiring that risks be defined and controlled.[56] ORM has broad application and scope and is intended to be incorporated into training, operations, and planning at all levels--with the objective of maximizing combat capability--utilizing four principles:

- Accept risk when the benefits outweigh the cost
- Accept no unnecessary risk
- Anticipate and manage risk by planning at all levels
- Make risk decisions at the right level

The DoD flying communities have incorporated risk management strategies into their training, procedures, and research. For example, crew resource management (CRM) has been incorporated into the aviation training curriculum of each service for several years as a proactive measure to reduce human factors contributing to mishaps. The Naval Safety Center's Human Factors Analysis and Classification System (HFACS), a ground-breaking approach to identification and elimination of human error in aviation mishaps, is another example of an initiative to proactively identify and reduce hazards, thereby supporting the DoD risk management initiative.

Despite the many successes on the road to achieving a safer flying environment, air traffic control is an aspect of the aviation environment that has not consistently

incorporated or utilized a risk management based approach. CRM, for example, is applicable to air traffic control crews as well as for flight deck crews as noted in an FAA sponsored study that concluded "...CRM,...will achieve an improved quality of work life for ATCSs (air traffic control specialists), improved team productivity, and improved safety for the flying public."[57] The FAA has a "CRM-type" initiative to address human factors and crew interaction, the Air Traffic Team Enhancement Program (ATTE), but only the Air Force has a similar CRM-type program.[58] Additionally, the Naval Safety Center's HFACS research also has applicability to air traffic crews, yet the air traffic community was neither included nor targeted in this research effort. Air traffic control, as one of the most basic and universal elements in aviation safety, should consciously incorporate operational risk management.

Conclusion

A centralized oversight strategy most effectively ensures standardization in system performance and safety, promotes early identification of developing problems, and promotes an additional layer of "checks and balances" and advocacy for problem resolution. This strategy is valid for both civil and military air traffic systems and is the optimum method to promote proactive, continuous system improvement. Therefore, a centralized strategy of system oversight would most effectively implement operational risk management for the military air traffic system. Further examination of the FAA's safety regulatory structure will first provide a baseline to then assess the DoD air traffic systems safety regulatory structures and their effectiveness.

CHAPTER 3

FAA OVERSIGHT OF THE NATIONAL AIRSPACE SYSTEM

As discussed earlier, the Federal Aviation Act of 1958 established a common system of air transportation with the Administrator of the FAA responsible for developing and operating the entire system. In order to understand how the Department of Defense air traffic system conducts safety oversight internally, the following aspects of the safety regulatory structure for the entire NAS and how the military fits into that must first be examined:

- Where system oversight occurs and whether it is characterized as centralized or decentralized
- Mechanisms to ensure compliance with standards and regulations
- Analysis of safety indicators
- Proactive or, "preventative" safety programs

FAA Organization for Oversight

The Office of Air Traffic Services, headed by the Assistant Administrator for Air Traffic, is responsible for directing, controlling, coordinating, and ensuring the safe and efficient utilization of the national airspace system. The Office of Air Traffic Investigations and Evaluations works directly for the Assistant Administrator of Air Traffic as an independent, objective mechanism to assess system performance, administer the quality assurance program, and conduct mishap investigations. This office routinely receives status and incident reports from the nine FAA regional offices, inspection results from the four independent inspection teams, and data and analysis regarding system performance from the Office of System Safety and the National Aviation Safety Data

Assessment Center (NASDAC) on a periodic basis (annual with quarterly updates).

System trends, deficiencies, and sometimes appropriate individual incidents or facility problems are tracked at the national level by the Air Traffic Service until they are resolved. The national level staff is involved in daily operations by design, viewing this not as micromanagement, but as an effective way to stay abreast of the needs and problems of a complex, dynamic system. Involvement by the national level staff includes participation in facility inspections, participation in mishap investigations, routine assessment of system performance and safety, development of corrective strategies in conjunction with the regional staffs, supervision of corrective action, and personal communication with regional and local level management.

As described above, the FAA's regulatory structure for air traffic operations, including oversight of safety issues is highly centralized at the national level in the Assistant Administrator for Air Traffic--the primary mechanism for this is found in the Office of Air Traffic Investigations and Evaluations. The only exception is the delegation of oversight of the military air traffic system to DoD.

Analysis of System Indicators

> In 1995, David Hinson, the FAA Administrator, challenged the industry to "Zero Accidents," and proposed a new and innovative approach to aviation safety, *an approach that is proactive rather than reactive*.[59] [my emphasis]

A strategy was developed to work toward the "Zero Accident" goal that included all-source fusion of aviation safety data and application of innovative information management and analytical capabilities. As part of this proactive safety strategy, the Office

of System Safety was created as an objective, independent safety policy advisor for the FAA and a focal point for aviation safety data and information. Current analytical methodologies and tools used by the Office of System Safety to monitor and study the NAS are:

> System Indicators-Provides information on the current status and trends in the NAS operations. The data includes accident and incident rates and measures of efficiency, inspector activity, compliance and environmental factors. Data is update quarterly and a full report is produced annually.
>
> Aviation Safety Reporting System (ASRS)-Comprised of voluntarily submitted aviation safety reports from pilots, air traffic controllers, and others in the aviation community for use in analysis and research. This FAA program is administered by the National Aeronautics and Space Administration (NASA).
>
> Aviation Safety Hotline-Receives reports about safety deficiencies from users of the NAS; caller identity is confidential if requested. Reports are tracked and safety concerns resolved.
>
> Human Factors Data-A major effort to better determine the possible causes of human error and develop appropriate strategies.[60]

System indicators drawn from NTSB, FAA, NASA, and the Bureau of Transportation Statistics databases are used to conduct data analysis, monitor safety trends, and identify emerging aviation issues and concerns for the FAA. The synthesis of information from these diverse sources provides a broad view of the national airspace operation and environment that is used to identify hazards and safety discrepancies in the NAS, to formulate policy, and to strengthen research.[61]

The *Aviation System Indicators Annual Report* contains 36 aviation systems and environmental indicators that are categorized in the following six areas that assess current and future system safety:

- Accident indicators

- Incident indicators
- Efficiency measures
- Compliance measures
- Inspector activity measures
- Aviation environmental indicators

The *Aviation Safety Statistical Handbook* is an annual executive summary of information on incidents and accidents within the NAS. Data is presented in tabular and graphical format for the following eight areas:

- near midair collisions (NMACs)
- operational errors (OE)
- operational deviations (OD)
- pilot deviations (PD)
- vehicle/pedestrian deviations (VPDs)
- runway incursions (RI)
- aircraft accidents[62]

Data are presented for a five year window and, where available, even earlier. Near midair collision data, for example, is given from 1959 to the present; aircraft accident data, operational errors, and operational deviations are given from 1980. This historical information provides additional opportunities to conduct analysis of the various influences on the system with the benefit of both hindsight and new investigative techniques.

The Office of Air Traffic Investigations and Evaluations maintains an on-going assessment of system indicators, starting with the daily brief to the Director of Air Traffic on all errors, deviations, incidents, or any other occurrences involving air traffic during the previous 24 hour period. The daily review and assessment of occurrences at the national level provides rapid identification of developing trends and responsive action in addressing them. Perhaps the biggest benefit of this close, daily involvement by senior leadership is that it keeps the focus of effort on operations and safety. Ron Morgan, then the Director of Air Traffic, made this point clearly at the 1997 FAA Air Traffic Quality Assurance

Conference by saying "A mentality of quality and safety should permeate the system; if leaders talk about this and focus on this it will get the rest of the organization thinking this way."[63]

The FAA Air Traffic Evaluations and Quality Assurance Programs

The FAA uses two intertwined mechanisms to ensure compliance with directives and standards: Facility Evaluations and the Air Traffic Quality Assurance (QA) Program. The Air Traffic Evaluations and Investigations Staff is responsible for oversight of both programs.

Previously embedded in other directives, the FAA QA program is now a separate program that is designed to build safe practices and keep all elements of the air traffic system focused on safety and the quality of services. Many aspects of the QA program are practices that have been previously utilized, but formal promulgation of these practices provides greater emphasis and specificity. The QA program articulates a systems approach to process improvement that requires active participation and communication between the individual controller, facility, hub, region, and national levels.[64] At the facility and regional levels, Quality Assurance programs are mandated to identify and correct deficiencies and to recognize successes. Programs are reviewed and approved by the next higher management level and, at a minimum, must address the following four areas:

Operational Error and Deviation Prevention. This program includes-

- feedback to controllers
- training programs (simulation, hearback/readback, tape talks)
- sharing lessons learned
- periodic QA briefs to controllers of facility trends and customer input

- periodic review of Monitor Alert Parameters
- Unsatisfactory Condition Report Program--aggressively identifies and resolves problems
- incorporate old OE/D scenarios into training program
- surface error prevention programs
- Regular, periodic review of facility operational error/deviation trends using the Analysis of Variance Program (ANOVA)

Promote Teamwork

- Air Traffic Teamwork Enhancement (ATTE)
- Teamwork recognition programs
- Position cross-training
- Supervisor skills course

Improve Communication. Designed to improve communications among all employees to create an atmosphere conducive to sharing information.

- Electronic Bulletin Board System
- Internet/intranet access
- National Database with facility, regional, and national QA information
- Newsletters
- QA seminars and conferences
- System-wide QA telecons
- Team briefings on trends and issues
- All hands meetings
- Industry reports (e.g. NTSB, ASRS, Air Line Pilots Association, and Aircraft Owners and Pilots Association newsletters)

Customer Service/Feedback. Program to solicit employee and customer feedback regarding the quality of services provided and the organization's impact on other organizations, users, and individuals.

- Operation Raincheck/Operation Takeoff
- Surveys of internal and external customers
- Interaction with other organizations (NTSB, Flight Standards District Office, Department of Defense)
- Employee evaluation of shift performance
- Familiarization flight
- Contacts with user organizations
- Pilot safety seminars and airport management workshops[65]

The QA program also provides direction for reporting and handling incidents and, for the first time, formally requires technical proficiency training for certified controllers to continuously improve their performance.[66]

The Air Traffic Evaluations Division, which contains both field activities and a Headquarters staff, is responsible for both conducting air traffic facility inspections and ensuring resolution of identified discrepancies. The four Evaluation Branch field activities that are located throughout CONUS comprehensively inspect every air traffic facility in the NAS on a two-year cycle and are augmented by the headquarters staff during inspections. Each field activity has 10-12 air traffic control specialists (ATCSs) that routinely have over 15 years of air traffic experience in operations and management. Objectivity in the evaluation process is maintained through direct accountability to the Director of Air Traffic; this direct line of authority also provides greater access and demonstrates the emphasis placed on the oversight process.[67]

The Air Traffic Evaluation Program specifies seven types of inspections at the national, regional, and facility levels; inspections that can be either scheduled or unscheduled. Teams from the designated Evaluations field activity spend two weeks at ARTCCs and level IV TRACONs and one week at all other facilities conducting the biennial full facility evaluations; in the interim years, the branches conduct follow-up visits or desk audits to ensure that corrective action is adequate. Four functional areas are inspected: training, quality assurance, administration, and operations; functional indices (FI) are established for each area to quantitatively assess the level of compliance at a facility that can elicit swift response if an area is found to be out of established parameters.

An inspection item is classified as a "problem" and assigned a control number for tracking if it meets the following criteria:

> a. Items in contradiction to a...directive.
>
> b. Items which negatively affect performance, programs, quality of service, or efficiency.
>
> c. Items identified as hub, regional, or national in scope...which requires action above the facility level.[68]

If a previously identified problem is found to be unresolved in a subsequent inspection, it is automatically classified at the next higher level for tracking and resolution.

Facility managers must take corrective action and provide written responses regarding corrective action no later than 45 days following the evaluation report date; subsequent responses are required every 90 days until all problems are resolved. Problems identified during evaluations are tracked at both the national and regional levels until corrective action is taken; regions close out the problem and the national level reviews this action. Regional offices must notify the Evaluations Branch that conducted the inspection of all corrective action taken at specified intervals.[69]

The national level Air Traffic Evaluations staff receives all inspection reports from the four field Branches and is actively involved in the inspection process including inspection schedule development, participation in facility evaluations, tracking problems until resolution, and final review of problem closures to ensure adequacy. Quarterly reports indicating the status of all open problems track the level of compliance system-wide.[70]

The FAA Air Traffic Evaluations Division does not require or maintain information on the conduct or results of military air traffic inspections. The FAA has entrusted

oversight of the military air traffic system to DoD with only a few exceptions; the FAA participates in military inspections only if requested and if personnel are available. How the Department of Defense air traffic system fits into the overall regulatory structure will be assessed below to illustrate the interaction between the agencies and DoD's responsibilities in the NAS.

FAA Oversight of the DoD Air Traffic System

Essentially, the oversight mechanisms that the FAA has to ensure that the air traffic system performance is efficient and safe--certification, inspections, and statistical analysis--have been delegated to DoD for military facilities with few exceptions. The FAA does require that military approach controls, towers located on joint-use[71] airports, and ground controller approach (GCA) units associated with nonradar approach control towers--that do not have an FAA Air Traffic Representative (ATREP) assigned-- be inspected semi-annually by the FAA regional air traffic division.[72] Controllers must be certificated by the FAA, however, only certification of Control Tower Operators (CTOs) is centrally managed by the FAA. The FAA also does not assess the DoD oversight process itself and does not receive data on DoD system performance and safety.

FAA Air Traffic Representatives (ATREPs). FAA Air Traffic Representatives (ATREPs) are ATCSs assigned to military facilities that serve as an "on site" observers and technical advisors. The authorization--not requirement--for ATREPs to be assigned to military approach control facilities is specifically provided for in an interagency agreement.[73] ATREPs provide liaison, technical advice and recommend improvements, but are not required to qualitatively assess or routinely report on military system

performance or safety. The only regulatory function required of ATREPs is to serve as a control tower operator (CTO) examiner and to recommend designation of alternate CTO examiners. The process for radar controller certification does not require ATREP involvement despite the fact that these controllers have much greater interface with air traffic in the NAS.

Controller Certification. Air traffic controllers are considered airmen and by law, must be certificated by the FAA. The processes for certificating tower and radar controllers are separate and distinct and must be both be examined.

Control tower operators (CTOs) are certificated by an FAA examiner through a centrally managed process. The controller receives a CTO certificate that is tracked in an FAA national database and changes in status, such as suspension or revocation or the certificate, can be tracked and readily identified. The regional Air Traffic Examiner oversees the CTO examiner process and is required to issues certificates, track examiners, and ensure their proficiency; this process applies to the designation of both civil and military CTO examiners.[74]

The process for certifying radar controllers is not administered or tracked in a database at the national level like the CTO process. Controllers are qualified at individual facilities and this is entered locally on an FAA form, FAA Air Traffic Control Specialist (ATCS) Form 7220-1. The differences between the two certification processes would be inconsequential except that decentralization in the certification process can lead to a lack of standardization. The FAA utilizes a nationally promulgated training program, with centralized enforcement of compliance through the Air Traffic Evaluation Program and Air Traffic Quality Assurance Program, to provide standardization of the certification

process.[75] For military radar controller certification, the process has been delegated to "...appropriate military authorities..." by the FAA.[76] Again, all oversight aspects of the military air traffic system are decentralized to the individual services, leading to varying interpretations of the certification process. The DoD approach, designed to provide greater flexibility to accommodate military requirements, inherently provides less standardization in the certification process than the FAA approach.

Conclusion

The FAA maintains highly centralized oversight of air traffic system performance and safety through the Office of Investigations and Evaluations at FAA Headquarters. In the early 1990s, system oversight--then accomplished largely at the regional level--was found to be ineffective. Mechanisms that are centrally managed at the national level to ensure system performance are the Air Traffic Evaluations Program, the Air Traffic Quality Assurance Program, and analysis of indicators of system safety.

It is clear that the FAA has entrusted DoD with almost all aspects of oversight for the military air traffic system performance and safety to accommodate the unique demands of military training and readiness. The few oversight mechanisms that the FAA utilizes to maintain contact with the military air traffic system--ATREPs, the controller certification process, and semi-annual inspections of selected facilities--have either been reduced or decentralized due to the effects of budget cuts and downsizing. The FAA neither assesses DoD's inspection or oversight process nor does it require reporting of any information regarding military system performance or safety.

The FAA has given DoD total responsibility for oversight of the military air traffic

system, even though it retains ultimately responsibility. Are the oversight mechanisms for the military air traffic system aggressively ensuring adequate levels of performance and safety? This will be determined by examining individual service oversight and then DoD oversight as a whole.

CHAPTER 4

DoD AIR TRAFFIC SAFETY REGULATORY STRUCTURES

Each U.S. armed service is responsible for ensuring that its air traffic facilities in the NAS are properly staffed, equipped, and managed; there is no central regulatory or oversight mechanism. The only DoD level forum where air traffic control operations are routinely addressed is the DoD Policy Board on Federal Aviation (PBFA). As its name indicates, this is a policy level agency that serves as a conduit to the FAA on all aviation issues between the FAA and DoD, not just air traffic. Policy regarding the operation of the military air traffic system is articulated in broad terms:

> It is DoD policy to:
>
> 3.1. Ensure that the Military Departments have sufficient airspace to fulfill military...requirements...Airspace...when not required by the Department of Defense, shall be made available to the FAA for civil use.
>
> 3.2. Cooperate with the FAA for the effective and efficient management of the NAS.
>
> 3.3. Ensure operational interoperability between the Department of Defense and the FAA and ensure equipment interoperability...
>
> 3.4 Actively participate in international aviation...to ensure DoD requirements and needs are addressed.
>
> 3.5 Ensure policies and procedures are in place in anticipation of the transfer of FAA responsibilities to the Department of Defense in case of war, in compliance with reference (d).
>
> 3.6 Have established a PBFA...[77]

How the services individually achieve compliance with DoD policy and FAA requirements is left to their discretion. The PBFA's function is not normally one of oversight or

involvement in the operation of the air traffic system; issues regarding air traffic system operations or oversight would be brought to the PBFA only if the individual members felt that this necessary on a case-by-case basis.[78]

The Office of the Inspector General can provide oversight of certain aspects of the air traffic system in the form of audits, such as the audit report published in February 1998 that evaluated the capabilities of DoD air traffic control and landing systems to support deployments.[79] Although certainly beneficial to audit individually identified issues, the Office of the Inspector General augments the oversight process as required but is not a part of the routine oversight process.

To accurately characterize oversight of the military air traffic system, each service's regulatory structure must be assessed since the responsibility has been delegated to them individually. The methodology used to assess how each service conducts oversight will be the same as that used to evaluate FAA oversight; four areas will be examined:

- Where system oversight occurs and the degree of centralization at the service level
- Mechanisms to ensure compliance with standards or regulations
- Routine analysis of system safety indicators and data
- Preventive, or Quality Assurance, programs

These four areas provide insight as to the degree that each oversight process is centralized and proactive. Chapter 2 asserted that a centralized oversight process has proven to be the most effective model in ensuring consistent levels of performance and safety; each service's process will be examined to determine where oversight occurs and the degree of centralization for the overall process. Characterization of the degree that

each system is proactive or reactive will be assessed through the examination of three elements: the enforcement mechanism, the routine data analysis process and preventive or, quality assurance, programs. Each service's inspection process will be examined since this is the primary mechanism that the services have chosen to routinely enforce compliance with standards. Routine analysis of data and system safety indicators is a significant part of a methodology seeking to derive predictive information that can be used to identify hazards and address them before they develop into serious problems; therefore, it can be considered a proactive aspect of oversight. Preventive or, quality assurance, programs seek to routinely build safe practices and improve communication throughout the air traffic system; these programs seek continuous system improvement and early identification of problems between major inspections.

Air Traffic Oversight by the U.S. Air Force

Centralized Oversight at the Service Level. The U.S. Air Force Flight Standards Agency (USAFFSA), discussed in Chapter 2, provides service-level management of the Air Force air traffic system through centralized accountability, reporting, and oversight. It has the authority to establish and enforce policy and maintains an active role in safety oversight. This is accomplished through detailed service level directives that establish oversight mechanisms and responsibilities, direct oversight of the inspection program, and centralized tracking and assessment of all system safety data at USAFFSA. The centralized oversight approach of USAFFSA minimizes interpretation of standards and promotes communication between all levels.

In essence, USAFFSA maintains a chain of command for the air traffic system that

has technical expertise to most effectively provide system guidance and supervision. In the 1994 organizational restructuring, the Air Force identified that its air traffic system needed more centralized oversight and that this oversight mechanism needed to have mature technical expertise in air traffic control. The Special Management Review noted that when the air traffic community had been removed from AFCC, operational group commanders had complete control over ATC decisions but did not have an adequate appreciation for the complex and rigid regulatory nature of air traffic operations, resulting in some system mismanagement as described below--

> ...leadership emphasis shifted from ATC operations being a part of the NAS to focusing on the flying activities of one wing. Several OG commanders stated, incorrectly, that they owned the airspace around their fields and would give their aircraft priority service at the expense of other traffic. As a result, some OG commanders made airspace, or even air traffic, decisions without seeking the functional expertise of ATC personnel...supervisors in ATC had a legal responsibility to follow federal regulatory guidance as part of the NAS, but this was not always recognized by others in the OG. [80]

Similar to the highly complex and technical nature of the flying communities, the air traffic control community also demands that all levels of management have substantial technical knowledge for the system to function in an optimum manner.[81] To effectively guide and supervise a system that is constantly changing yet has little room for error, all levels of management must also keep "in touch" with the operational environment--such as the FAA's national level staff conducting daily briefings on operations, personal involvement in communication with regions and facilities, and participation in the inspection process. USAFFSA emulates this involved, centralized oversight with a staff of 43, predominantly senior, air traffic control specialists. USAFFSA conducts conferences with the MAJCOMs twice a year to discuss all issues and the MAJCOMs also

conduct their own annual conferences to focus on unit needs, to promote standardization, and to provide education--USAFFSA attends all MAJCOM conferences.[82] USAFFSA staff members routinely participate in facility evaluations, receive results from all inspections, and assess overall system performance.[83] All system safety indicators--including HATRs, inspection results, and any other indictors-- are required to be reported to USAFFSA where they are tracked, analyzed, and published in quarterly and annual reports.

Detailed, service level directives require oversight. USAFFSA promulgates detailed directives that establish oversight requirements and procedures at all levels. Two service level directives provide detailed air traffic guidance, precluding the need for elaboration in local directives that could dilute standardization. *Air Traffic Control* (AFI 13-203) directs air traffic controller training, air traffic operations, the air traffic quality assurance program, and the Airfield Operations Board. *The Air Traffic System Evaluation Program* (AFI 13-218) provides guidance for conducting the evaluation of the air traffic system's safety, effectiveness, and compliance with HQ USAF and FAA standards.

The Air Traffic System Evaluation Program (ATSEP). The Air Force's primary means to ensure air traffic system compliance with standards is through a two-pronged inspection--the ATSEP. Each air traffic facility is evaluated during a five day, detailed inspection every two years; the two separate inspection programs of the ATSEP are normally conducted concurrently and assess the following areas:

1. Air Traffic System Analysis (ATSA). This program assesses the quality, adequacy, and safety of the air traffic system by evaluating system capability, air traffic

control and flight procedures, and base operations--facilities and procedures. This evaluation looks at "the big picture" by assessing the overall functioning of the system; everything that impacts or is impacted by any portion of the air traffic system within an approximately 40 mile radius of air traffic facility is assessed.

2. Airfield Operations Standardization Evaluation (AOSE). This program assesses and quantifies the level of compliance with guidance and standards. It is a highly detailed, hands-on evaluation through observing facility/position operations, reviewing local procedures and documentation, and testing. The absence of rigorous controller performance assessment was felt to have contributed to the degradation of flight safety prior to the formation of USAFFSA. AOSE was designed to prevent this from happening again by providing detailed assessment through first-hand observation of individual and team controller performance.[84] A conformity index is established for the facility by combining numerical scores of each functional area.[85] Special interest items--items with a high priority, such as trends impacting safety or combat readiness--can also be added to inspections.

USAFFSA has a staff of eight personnel that oversee the major command (MAJCOM) evaluation programs; each of the ten MAJCOMs have an Office of Primary Responsibility for air traffic with a staff of 6 to 27 air traffic control specialists. These offices not only inspect all air traffic facilities on a two year cycle, but they also provide subject area expertise, review contractual or procedural air traffic documents, and oversee resolution of inspection discrepancies.[86]

Follow-up by the Airfield Operations Board (AOB), chaired by the Airfield Operations Flight commander (AOF/CC), is required within 30 days and individual

commands are held accountable to the MAJCOM until all discrepancies are resolved. MAJCOMs have closure authority (i.e., decide when discrepancies have been adequately addressed) and are required to report inspection results and action taken to resolve discrepancies to USAFFSA.[87]

Indicators of System Safety. USAFFSA is the central point for collection, analysis, and dissemination of service-wide air traffic system safety indicators. Indicators include reportable incidents filed in the Hazardous Air Traffic Report (HATR) Program, service-wide trends noted in inspections, information that may be brought out during mishap investigations, or information reported through other means such as the minutes of the AOB.

The Air Force does not require its air traffic facilities to self-report incidents such as operational errors or deviations; reporting is accomplished through a less punitive program--the Hazardous Air Traffic Report (HATR) Program. The HATR Program is designed to provide a means to encourage reporting in order to obtain the safety data that can identify potential hazards and distribute mishap prevention information in a timely manner. Reportable incidents also include near midair collisions, communication or navigation aids that could have contributed to a hazardous air traffic condition, or any incident, system, directive or procedure that could have contributed to a hazardous air traffic condition.[88]

HATRs are now reported and tracked at the Air Force Safety Center; this function was recently returned from USAFFSA, where the program had been conducted from 1994 until April 1998. Manpower and funding cutbacks did away with the only air traffic specialist on staff at the Air Force Safety Center in 1994 and USAFFSA voluntarily

created a database and assumed the functions of data collection, assessment, and distribution of safety related information.[89] The ATCS position at the Air Force Safety Center was filled in April 1998 and, subsequently, the HATR database was returned.[90] Like any program that is dependent upon reporting, the effectiveness of the HATR program depends upon the willingness of individuals to report observed incidents and, consequently, upon the actions and attitudes of leadership. Reporting difficulties have been identified in the Air Force HATR program; the Special Management Review noted "...a significant downturn in the volume of HATRs filed with AFSA...the number of reported incidents steadily dropped form 345 in CY 87 to 117 in CY 93."[91] The report noted that filing a HATR was perceived to be punitive and leadership needed to reinforce the positive aspects of the program. A reduction in the number of reported incidents was again noted in 1995 by USAFFSA with only 86 HATRs filed; emphasis by the executive agency resulted in the numbers of reported incidents increasing to 129 in 1996.[92]

Other indicators of system performance are obtained through the Airfield Operations Board; AOB minutes are required to be forwarded to both the MAJCOM and to USAFFSA to follow resolution of inspection discrepancies and for information sharing. It was through information provided by AOB minutes that USAFFSA was recently able to identify a trend in runway incursions; of the 72 runway incursions reported from October 1995 to September 1996, most were identified through AOB minutes.[93] This method of identification is unique to the Air Force and promotes routine, timely identification of developing system problems.

ATSEP results are reported to USAFFSA where they are compiled and analyzed. USAFFSA tracks each discrepancy until the MAJCOM closes it, then reviews the closure

report to ensure that sufficient action was taken. Maintaining this level of awareness regarding individual problems facilitates responsive and timely service-level intervention and advocacy when it is needed. Trends and lessons learned from all sources--evaluation results, HATRs, AOB minutes, and any other sources--are combined in quarterly and annual reports at USAFFSA and distributed service-wide. General officer review of air traffic system quarterly and annual reports at both the service and MAJCOM levels also provides advocacy and responsive intervention; evaluation results and action to correct discrepancies are reviewed at the MAJCOM level and assessments of overall system functioning and trends are reviewed at the service-level.[94]

Proactive Safety Programs. The Air Force air traffic quality assurance effort has the following programs that actively seek to build safe practices and enhance communication in the air traffic system:

- Externally Managed Programs (evaluations)
- Internally Managed Programs
  - ⇒ Periodic Facility Evaluations
  - ⇒ Annual Facility Evaluations
  - ⇒ Annual Automation Evaluations
- Cooperative Quality Assurance Programs
  - ⇒ Midair Collision Avoidance Program
  - ⇒ Pilot/Controller Liaison Program
- Airfield Operations Board

Externally managed quality assurance programs essentially are the inspection programs—the ATSEP as discussed previously and the ATCALS Evaluation Program for tactical air traffic systems. *Internally managed quality assurance programs* are conducted at the local level (fixed-base facilities) to continuously assess controller

performance and facility standardization. This is done through periodic evaluations by each facility's Chief, Standardization and Evaluation (CSE), an ATCS that has at least 5 years of experience, is facility rated (rated in all positions at the facility assigned), and has served previously as an operational air traffic supervisor and training specialist. The CSE must conduct and document periodic evaluations of each crew's performance at least every 90 days and each controller's performance annually; positions to be evaluated are specified and checklists provided to conduct evaluations are specified in the service directive. The Chief, Standardization and Evaluation for Automation is also required to annually evaluate each air traffic automation specialist to ensure proficiency and compliance with standards.[95]

Cooperative Quality Assurance Programs require the integrated participation of several agencies to successfully implement the program. The Midair Collision Avoidance Program is a method to obtain feedback from all customers, targeting any system user or anyone affected by air traffic within an approximately 40-mile radius from the air traffic facility. Efforts can include briefings with flying clubs, civic organizations, or other military air traffic or flying units; each program is tailored to the area. The program is focused off base since there is a separate program designed to conduct liaison internal to the base. This is designed to improve both service and safety; it is also a means for the military base commander to demonstrate the military community's goodwill and responsibility.

The Pilot/Controller Liaison Program attempts to build greater understanding between tenant squadrons and the air traffic control facility by assigning one or more air traffic liaison controller(s) to each flying squadron. The liaison provides a highly

accessible source for training, information briefs, orientation tours for new pilots, and a conduit for routine exchange of concerns between controllers and pilots. Issues that might not normally prompt a pilot to contact the ATC facility are more likely to surface if a rapport is established and a knowledgeable and interested controller is available. Hopefully, issues can be addressed to better support the flying community and resolve "non-issues" before they develop into more serious problems.

The Airfield Operations Board (AOB) is a quarterly forum at every air base where the diverse functional areas of the airfield meet to discuss airspace, ATC, other armed service/FAA/host nation concerns, staffing and proficiency, ATCALS, the airfield environment, Hazardous Air Traffic Reports, and ATSEP discrepancies.[96] In addition to this being a common sense way to communicate routine issues, the AOB's specific guidance to handle several safety related issues keeps the entire system focused on safety.

Summary of U.S. Air Force Oversight. Oversight of Air Force air traffic system performance and safety is conducted at the service-level by the U.S. Air Force Flight Standards Agency. This is accomplished through detailed, service-level directives, USAFFSA's direct involvement in the Air Traffic System Evaluation and HATR programs, and system-wide accountability to USAFFSA. USAFFSA receives all air traffic system safety indicators, evaluates them, publishes this analysis service-wide, and oversees corrective action taken to resolve system problems. USAFFSA is able to accomplish detailed oversight by having adequate staff to conduct detailed statistical analysis and maintain personal involvement in subordinate activities. Service directives require several proactive safety programs that actively seek to identify hazards and correct them before they result in mishaps. The safety regulatory system actively attempts to make the system

safer and to identify problems early--the Air Force utilizes a centralized, proactive oversight strategy for its air traffic system that effectively incorporates operational risk management.

Air Traffic Oversight by the Naval services

While the Chief of Naval Operations (CNO) and the Commandant of the Marine Corps are responsible for their respective air traffic systems, CNO (N885F) is responsible for establishing and promulgating requirements for the functional area (termed the "model manager") for the Naval Air Training and Operating Procedures Standardization (NATOPS) Air Traffic Control Facilities Manual.[97] This service-level directive establishes requirements and procedures for the operation of all Navy and Marine fixed-base air traffic control facilities, consequently, oversight of the Navy and Marine air traffic systems mirror each other in many respects.

The NATOPS Manual delegates oversight to allow a high degree of flexibility at both the individual facility and Type Command (TYCOM) levels to accommodate demanding and diverse mission requirements. While both services maintain some oversight functions at the service-level, the majority of functions are delegated, to include oversight of system performance and safety; this approach is best characterized as decentralized. Therefore, an examination of the Navy and Marine Corps air traffic system safety regulatory structures requires an assessment of oversight at all levels.

Service-level oversight. Neither CNO nor CMC require or receive all indicators of system safety; the only system safety indicators that are reported directly to them are operational errors. Hazard Reports (HAZREPs) are reported to the Naval Safety Center

and are then forwarded to CMC and CNO as necessary.[98] Identifying system trends, resolving deficiencies, and establishing management controls to prevent problems from recurring are all oversight functions that have been delegated to the TYCOMs. Both CNO and CMC defer analysis of system indicators to the Naval Safety Center.[99] Three air traffic control specialists are assigned to CNO and one to CMC; the CNO and CMC staffs do not provide oversight or participate in the inspection process.[100] CNO conducts an annual conference for all Navy and Marine air traffic activities that shares community information and reviews the service directive.

The service-level directive is designed to permit interpretation and subjectivity; it does not provide extensive detail regarding oversight processes, thereby requiring subordinate commands to develop their own directives to specify how oversight will be conducted. The requirement for the NATOPS QA Program, for example, is promulgated in two paragraphs of the service directive; conduct of inspections, methods of reporting and analysis, and sharing of results with external agencies is left to each TYCOM's discretion. While some commands have worked together to develop joint inspection procedures, such as the joint order between the Commanders, Naval Air Forces U.S. Pacific Fleet and U.S. Atlantic Fleet, this achieves standardization between only two of the four Navy TYCOMs. Additionally, this order addresses only the conduct of the evaluation process within the two TYCOMs; it does not require comprehensive analysis of evaluation results or system indicators, sharing of information between TYCOMs, or an ongoing quality assurance effort.[101] Methodologies of the Navy and Marine Corps for air traffic system oversight differ even further at the TYCOM level and will be discussed separately.

Navy TYCOMs. Evaluations are the primary mechanism within the TYCOMs to conduct oversight of their air traffic facilities. Biennial inspections of air traffic activities within the TYCOM are accomplished with teams of two to four air traffic control specialists and maintenance technicians that are part of the type commander staffs. These teams serve as subject area experts to the facilities within the TYCOM, advise the type commander, and administer the NATOPS Air Traffic Control Quality Assurance Program--the Navy's ATC inspection program.[102] Heading up each team is a Navy ATC limited duty officer that has spent his or her entire career in operational air traffic control, which is relevant in understanding the Navy's decentralized approach to system oversight. The expectation is that this robust experience level throughout Navy ATC leadership--which is unique among the armed services--will identify hazards and address safety issues without extensive oversight.[103] Because the TYCOMs are not tied down with the administrative burdens of "micromanagement" by the service-level, the TYCOMs are expected to be able to provide more responsive management.

QA staff specialists and their teams are currently assigned to four TYCOMs and inspect all Navy air traffic activities on a two-year cycle. Inspection teams are augmented by other senior enlisted Navy controllers to tailor the team to the size and complexity of each facility. The NATOPS Manual provides general guidance on inspection conduct that includes functional areas to be inspected, periodicity of inspections, and follow-up at 30-day intervals to the TYCOM for problem resolution; no further specific guidance is provided. Reports of inspection results are required to be sent to commanding officers within 15 days after the conclusion of the evaluation and individual commands are held accountable to the TYCOM until major discrepancies are corrected.[104]

Inspection results are neither required nor are routinely provided to agencies outside the TYCOM; results are not required to be compiled at the TYCOM or service level for trend analysis or hazard identification. Issues are brought to the attention of CNO on a case-by-case basis only if subordinate commands feel that they need to elevate an issue. The only routine service-wide assessment of the Navy air traffic system is a quantitative one, the Annual Air Traffic Activity Report.[105]

Marine TYCOMs. Oversight of the Marine air traffic system is also accomplished primarily through facility inspections; however, inspections have been accomplished through the command inspection process and not the NATOPS ATC Quality Assurance Program with the following requirements:

> Type commanders shall establish an air traffic control quality assurance team...Quality assurance evaluation teams shall be under the cognizance of the air traffic control specialist assigned to type commander staffs...[106]

Although the Marine quality assurance (inspection) program is currently being assessed to bring it more in line with the NATOPS requirements, the program has lacked both QA inspection teams and TYCOM air traffic specialists.[107] This inspection process, determined to be ineffective and non-existent in a recent study of the Marine air traffic community,[108] placed a substantial portion of oversight responsibilities on individual air traffic control facility officers.

Pervasive technical expertise in air traffic leadership is the key to success in the decentralized NATOPS approach to system oversight, however, this expertise is much lower in Marine ATC leadership and more problematic for the Marine air traffic system safety regulatory structure. Although Navy and Marine air traffic facilities have different

management structures defined in the NATOPS, the requirements for a facility officer are essentially the same and require minimal experience and qualifications.[109] The difference is that the Marine Corps does not have warrant or restricted officers and the career path for unrestricted Marine ATC officers develops their technical skills broadly for Aviation Command and Control but does not provide the depth in ATC expertise found in Navy officers.

During the last three years, initial training time for Marine ATC officers has ranged from 11 to 15 months; this is normally the only exposure that officer will have in a fixed-base air traffic environment prior to assignment as an air traffic facility manager in the NAS.[110] Although the standard is essentially the same for both Naval services, the actual experience level is significantly different with Navy ATC officers having an average experience level of ten years compared to an experience level of less than two years for Marine ATC officers.[111] A decline in officer experience was noted by the Air Force SMR as a significant factor contributing to system degradation that eventually resulted in the series of mishaps in 1992-1994; the report had the following comment and recommendations concerning technical expertise for ATC officers:

> First-assignment ATC officers should be allowed to stay in an ATC facility gaining hands-on technical expertise to build a knowledge base. While some career fields do not require technical expertise in their junior officers, air traffic control, like flying, *requires a level of technical expertise which can only be obtained through hands-on experience*. To do this, all levels must enforce the facility experience requirement...The team found that *officers with less than 5 years experience...were considered far less effective...*[112] (my emphasis)

Recognition of the need for a high level of expertise in ATC officers is not present in the Marine Corps, as demonstrated by a reduction in the service-level requirements for Marine ATC officer position qualifications in 1997; four minor position qualifications

were required previously, now only two qualifications and six months experience in a fixed-base facility are required .[113] Another factor potentially contributing to a decline in officer experience levels was the reorganization of tactical air traffic units in 1994 as a result of downsizing; air traffic control squadrons were deactivated and air traffic detachments were placed into air defense squadrons. Previously, the air traffic squadrons provided a unique mentoring environment for young officers since almost all staff members were air traffic controllers. This is no longer the environment that officers return to after completing initial training; the experience base in air traffic control in the air defense squadrons is much lower. Declining experience levels in leadership, cited in both the Air Force and Army reorganization studies as contributing to system degradation, could also be a factor contributing to the degradation of oversight of the Marine air traffic system as discussed below.[114]

In 1996, concerns were voiced from the Marine air traffic community regarding manpower, training, and quality assurance and a Process Action Team (PAT) at Headquarters, U.S. Marine Corps was chartered to study these issues.[115] The six member PAT visited every Marine Corps ATC unit; the study concluded in the spring of 1997 and a final report has not yet been published.[116] Issues identified include:

- Complex manpower structure negatively impacting training and staffing
- Tour lengths insufficient to accommodate training requirements
- Unstandardized training
- Non-existent ATC QA Program (i.e., the inspection program)
- Inadequate training for maintenance technicians
- Service-wide forum needed to resolve issues between fixed base and expeditionary units[117]

While the status report did not specifically address the impact of these systemic problems on the safety of air traffic facilities in the NAS, the inadequacy of the service's primary

enforcement and assessment mechanism identified in this study (the inspection program was termed "non-existent") raises concern in this regard. While the need for a more aggressive and technically oriented quality assurance program (i.e., inspection program) was identified and some individual actions have been taken, a service-level quality assurance program has not yet been developed.[118] Subordinate commands are developing their own programs that will be assessed for possible incorporation into a service-wide program; how this will be accomplished has not yet been determined.[119]

Analysis of System Safety Indicators. The approach to analyzing air traffic system safety indicators is the same for both the Navy and Marine Corps and will, therefore, be discussed together. Both CNO and CMC review and individually evaluate incident reports when they are received, but do not conduct system-wide analysis of safety indicators; this is not required at the TYCOM level either. System-wide analysis has, therefore, been deferred to the Naval Safety Center.[120] While the Naval Safety Center does receive both Hazard Reports (HAZREPs)--including near midair collisions, pilot deviations, and other conditions hazardous to flight--and operational errors, it does not receive results, analysis, or any information from the evaluation process or other sources.[121] Information obtained from a detailed, rigorous inspection process can provide valuable insight and reveal subtle indications of deterioration that may not appear in reported incidents. There is no quality assurance program or the equivalent of the Air Force's Airfield Operations Board minutes to routinely gather information from other sources and form a more comprehensive picture of system functioning. No one agency in either the Navy or Marine Corps has all available system safety indicators with which to effectively conduct analysis and, therefore, to maintain proactive oversight.

Only one air traffic control specialist is assigned to the Naval Safety Center to maintain the database for reported operational errors and HAZREPs, serve as the subject area expert for the Naval Safety Center, review all Safety Center literature concerning ATC prior to publication, participate in mishap investigations, and conduct surveys of every Marine and Navy air traffic facility every two years.[122] A survey is a two or three day visit to an air traffic facility to assess its safety posture and make recommendations--surveys are advisory only and cannot require changes. In addition to the above duties, the current air traffic control specialist is also the Command Master Chief.

The Naval Safety Center does not routinely conduct statistical analysis of either the Navy or Marine air traffic systems. However, a one-time analysis of system indicators maintained at the Safety Center was completed in 1997 in an attempt to quantify concerns that had been observed during surveys and mishap investigations. Conducting an accurate assessment was difficult since system data had not been tracked prior to 1995 and there was no established methodology for analysis of the air traffic system established at the Naval Safety Center.[123]

Proactive Safety Programs. The only proactive safety program in the Naval services that requires the involvement of the air traffic community is the HAZREP Program. This program, part of the Naval Aviation Safety Program, requires reporting by any person who witnesses a hazard to aviation that did not result in a mishap.[124] Reports are made directly to the Naval Safety Center and can be anonymous; any incident considered hazardous to flying can be reported.

The Naval services do not have an air traffic quality assurance program; while there is a NATOPS Quality Assurance Program, this is an evaluation program only. There

is no program that conducts "interim maintenance" of the air traffic system in the two-year period between facility evaluations nor is there a program that requires routine communication between system elements and builds safe practices. For example, there is no requirement for internal facility evaluations between the biennial inspections such as is found in both the Air Force and FAA QA programs. Even the joint AIRLANT/AIRPAC order, which is much more detailed than the NATOPS, does not require continuous, internal evaluation of facilities.[125] There are elements of the NATOPS that could be part of a QA program, such as the guidance to "train as a team," crosstrain controllers, conduct periodic briefings on aircraft characteristics and flight physiology/psychology, and conduct orientation flights.[126] However, neither periodicity nor methodology is specified and these individual requirements do not form a comprehensive quality assurance program.

While there is no specified QA position in facility management, the Training Chief (USN)/Training and Standardization Supervisor (USMC) positions are required to be experienced controllers that oversee facility training, certification, and standardization.[127] This individual can provide the functions of a QA position, however, program requirements are not specified and the program focus, scope, and effectiveness will vary with workloads and individual priorities. Additionally, there are no specific requirements for the Navy or Marine ATC communities to initiate dialogue or seek feedback from either system users or those impacted by the ATC system. Certainly communication would occur without an established requirement, but the frequency, audience targeted, and focus of dialogue will vary. Programs without defined requirements can easily become unstandardized and fall into disuse when priorities and resources change.

Summary of air traffic oversight by the Naval services.

System oversight by both the U.S. Navy and U.S. Marine Corps is decentralized with the TYCOMs responsible for the conduct and oversight of the NATOPS Quality Assurance Program--the air traffic inspection program. TYCOM inspection programs are the primary means to ensure that system performance and safety are adequate; inspections are not conducted by either CNO or CMC to assess the effectiveness of the TYCOM programs. Analysis of system safety indicators is neither required nor conducted on a routine basis and no one agency currently receives all data to do this. While there are some elements of an ongoing quality assurance effort in the NATOPS, requirements do not collectively provide a process for continuous system oversight and improvement. The air traffic system oversight strategy for the Naval services is decentralized and does not actively incorporate operational risk management.

Air Traffic Oversight by the Army

Oversight of Army air traffic issues rests with the U.S. Army Air Traffic Control Activity (USAATCA) at Ft. Rucker, Alabama. USAATCA serves as the functional proponent for planning, standardizing, and evaluating air traffic systems. Its director has oversight for ATC QA and training and is responsible for--

> Establishing administrative and operational policies, procedures and standards for ATC facilities and services, and
>
> Standardizing, evaluating, and determining the quality of ATC operations, training, and equipment maintenance.[128]

However, the 1996 U.S. Army ATC Organization and Management Assessment (O&MA) by the U.S. Army Force Integration Support Agency (USAFISA) indicated the current

organizational structure of the Army air traffic community does not provide effective oversight and compliance. It describes USAATCA as "impotent" and command and control of the mission area as having "...No technical chain, no safety surety, broken connectivity, no equipment standardization, and major morale problems."[129] The study concludes "The Army ATC system is in distress, rapidly deteriorating, and without immediate HQDA directed intervention, will soon be in an unrecoverable state."[130]

A centralized management structure encompassing fixed-base ATC facilities and tactical ATC units, termed the "1996 Army ATC Redesign Initiative (96 A2RI)", is recommended by the study as the organizational model that should be adopted.[131] 96 A2RI recommendations are intended to be comprehensive in order to completely redesign mission area organization and oversight. The safety regulatory structure for the Army was not, however, specifically addressed in the study and will be discussed below.

Service level oversight. Inspection results are only provided to the local commands; results of inspections are not compiled or assessed at the service level.[132] There is no accountability to either the major command (MACOM) or service levels for correction of discrepancies; compliance is delegated to the individual command level. Some system safety indicators are reported to USAATCA, however, none are currently being reported to the Army Safety Center--neither receives all system safety indicators to conduct complete analysis of system performance and safety. There is no requirement for analysis of air traffic system indicators to be conducted at the MACOM, service level, or the Army Safety Center and none is routinely conducted.[133]

The Army ATC Inspection Program. Service directives only assign responsibility for the evaluation program but do not provide guidance on the conduct of inspections,

reporting results, or program oversight; total guidance for the inspection process is contained in four paragraphs.[134] The Army has only one official ATC Quality Assurance/Inspection Team, serving as part of the Aviation Branch's Resource Management Survey (ARMS) team.[135] The team is comprised of two flight inspection pilots, two maintenance technicians, and one air traffic control specialist. The crew is certified by the FAA to conduct flight inspections and maintains this mission in addition to conducting three to five day inspections of every air traffic facility in the Army on a two-year cycle. With only one controller assigned to the team, this is inadequate to evaluate controller performance at larger facilities. To compensate for this, the practice has been for a flight inspection pilot to assist in assessment of controller performance on position, despite the pilot having no formal training or certification in air traffic control.[136] The ATC QA team does not have an ATC officer assigned since there are none in the Army, with the exception of a handful of warrant officers nearing retirement.[137]

Results are not provided to the MACOM or service level and resolution of discrepancies is not overseen or tracked at these levels.[138] No trends, concerns, or information obtained during inspections is shared with the Army Safety Center and the ATC QA team is not required and does not compile service-wide inspection results.[139] Despite this team's being one of the few checks and balances for the Army's air traffic system, it has been considered for elimination several times recently due to manpower reductions.[140] The frustration level of this team is high as they attempt to provide assistance to a system in distress with few resources and limited support.

Analysis of System Safety Indicators. The Army Aviation Accident Prevention Program establishes the Operational Hazard Reporting (OHR) Program as the sole means

for air traffic system safety indicators to be reported. The OHR Program is used to record information about hazardous acts or conditions before a mishap and to correct hazards at "...the lowest level possible."[141] Operational hazards include inadequacies, deficiencies, or unsafe practices pertaining to--

- Air traffic control
- Airways and navigational aids
- Controller procedures and techniques
- Near midair collisions between aircraft or near collisions between aircraft and other objects in the air or on the ground
- Aircraft operations
- Aircraft maintenance or inspection
- Weather services
- Airfields, heliports, facilities or services
- Flight or maintenance training and education
- Regulations, directives, and publications issued by DoD agencies, the FAA, International Civil Aviation Organization (ICAO), and host nations[142]

OHRs are tracked and resolved locally; forwarding is discretionary and only required in specific instances. Reports are forwarded to the Army Safety Center when actions are significant or involve an agency outside to the Army. Incidents involving a civil aircraft or FAA ATC require reporting to the appropriate FAA regional offices and incidents involving Army ATC are required to be submitted to USAATCA. USAATCA has received no OHRs in the past six years and has only two are on file submitted prior to that.[143] The Army Safety Center has no record of receiving any OHRs involving air traffic control.[144]

The only information that the Army Safety Center maintains on air traffic control is that obtained during mishap investigations. No air traffic specialist is on staff and different controllers in the local area are used to provide subject area expertise when required. There is no routine compilation of air traffic information drawn from mishaps, no trend analysis conducted, and no single subject area expert reviewing the mishap information

that is available.[145] When a list of air traffic system indicators maintained by the Army Safety Center was requested as part of this research project, a database search had to be completed to extract this information; there was no knowledge of any air traffic data being compiled during the last ten years.[146]

Preventative Safety Programs. The only Army program involving ATC that seeks to promote safe practices and to enhance communication is the OHR Program. The thrust of the program is preventative, much like the Navy HAZREP and Air Force HATR programs. There are several unit level programs or requirements that are part of the Army Aviation Accident Prevent Program to include:

- Aviation Accident Prevention Surveys
- Unit Safety Councils
- Aviation Hazard Analysis and Risk Assessment [147]

Aviation Accident Prevention Surveys are locally conducted inspections of functional areas; air traffic control is included. This can be an effective tool to identify problem areas early, however, the quality of these inspections is dependent upon the experience level of the ATCSs conducting them. The current service-wide experience deficit, for example, does not provide surety that this will be a consistently effective tool. The Unit Aviation Safety Councils and Hazard Assessments would logically include air traffic participation, but this is not required in the service-directive.[148]

The USAFISA study indicated that organizational problems combined with the Army "Can Do" spirit suppressed identification of safety related system problems:

> Personnel in the ATC system were and are reluctant to state the real problems... [they] see screaming too loudly or calling attention to safety or readiness being translated into a lack of confidence by those they support. They also fear that the smack on the hand will return for them to solve and they do not have the capability to solve...[149]

The study goes so far as to say that safety factors and policy were actively being ignored as illustrated in the following passage:

> The regulatory provisions for emergency manning levels and minimum shift requirements are often ignored by the facilities in the field...individual facility managers...make decisions on local and economic factors, rather than Army policy, ignoring degraded safety.[150]

This non-compliance with regulations by operating at emergency manning levels as the norm rather than the exception is more likely driven by the ethos of mission accomplishment rather than by defiance or ineptitude.[151] In essence, the lack of a higher level risk management mechanism forced individual facility managers to do their own risk assessment of the costs and benefits of continuing to operate at levels that supported the current tempo of operations.

There is no ongoing quality assurance program, no quality assurance position in air traffic facility management, or quality assurance duties required in other management positions specified by the service directive; the only continuous oversight directed is that the ATC Facility Chief "...develops and maintains a training program."[152] There is no requirement, for example, for continuous, internal assessment of controllers, crews, or facilities.

Summary of Army Oversight. The Army air traffic control safety regulatory structure is decentralized, reactive, and does not effectively incorporate operational risk management. While the approach to hazard identification resolves individual problems, it suppresses reporting of system safety indicators and resolution of higher level problems. Consequently, system safety indicators are underreported and analysis cannot be accomplished; in fact, analysis has not been conducted for several years. Underlying system problems, therefore, are not readily identified and can become serious hazards

before being identified. The Army is working to resolve the underlying organizational problem in the air traffic control mission area and this should improve overall system functioning, safety, and combat readiness. However, the safety regulatory structure has not been examined to determine whether it is adequate to ensure consistent system performance and safety into the future.

Comparison of Service Oversight Strategies

The most effective approach to system oversight is one that is proactive and incorporates risk management. A proactive, risk management based approach to air traffic system oversight is characterized by the presence of four factors: centralized oversight; a centralized compliance mechanism--for DoD, this is the inspection process; routine system analysis of safety information and data; and an on-going, quality assurance program. A comparison of these four factors is instrumental in determining the degree to which each service's air traffic regulatory structure can be characterized as proactive and effectively incorporating operational risk management.

Centralized oversight. First, oversight must be characterized as essentially centralized or decentralized. This determination is based upon the level of detail found in service directives, the level of involvement of the service's executive agency in oversight processes, and the degree of system accountability required to the service level. The Air Force promulgates detailed service level directives specifying air traffic oversight processes and accountability; it is the only service requiring accountability to the service level for routine system performance and safety. Additionally, the Air Force has the only executive agency with routine, personal involvement in the oversight process itself.

Oversight within the Naval services is decentralized with accountability delegated to the TYCOM level; the executive agencies are not routinely involved in the oversight process. Army directives are not explicit regarding oversight processes and, while technically having a centralized executive agency in USAATCA, it has been identified as being ineffective along with the entire functional area organizational structure. System accountability is largely at the individual command level.

Centralized inspection process. Second, each service's mechanism to ensure compliance with standards must be characterized as a centralized or decentralized process; all services use biennial inspections of fixed-base air traffic facilities as their primary compliance mechanism. The Army has a centralized structure with one inspection team, however, assessment of results and discrepancy resolution are not effectively centralized for the mission area. The Navy and Marine Corps have delegated the inspection process to major subordinate commands and the service level neither participates in nor maintains oversight of the process. The Air Force has a centralized process with USAFFSA overseeing conduct of inspections, assessing service-wide results, overseeing problem resolution, and participating in inspections.

Routine system analysis. The third factor is a determination of whether or not routine analysis of system safety indicators is required and conducted. Only the Air Force's executive agency requires and conducts routine statistical analysis of all system safety indicators. The Air Force produces detailed, thorough (some up to 40 pages) quarterly and annual Air Traffic System Trend and Analysis Reports that compile results from the ATSEP, HATR program, and other sources to identify problems in detail. Review at the flag officer level illustrates the level of support and advocacy for system

oversight. The other services produce no reports that qualitatively assess system performance routinely. The safety centers do not routinely compile information from all sources, nor do they conduct routine analysis of the information that they have available. All services have experienced problems with incident reporting and incident reporting in the Army is essentially non-existent.

Preventive Safety Programs. The fourth and final factor is the presence of preventive programs--a quality assurance program or equivalent programs. The Air Force has a detailed quality assurance program that requires communication between all system elements and provides a methodology for continuous process improvement. Even though the Naval services have some QA type requirements, neither they nor the Army have programs that actively engage all system elements to improve communication and build safe practices.

Figure 3 is a matrix that graphically illustrates the overall success of each service's air traffic oversight process in being proactive and incorporating operational risk management by comparing these four factors. The colors indicate the degree that each of these factors is present in each service's oversight process--green indicates the factor is present. The far right column provides an overall assessment of whether or not the system's strategy is proactive and incorporates operational risk management. Only one service--the Air Force--has an oversight system that is characterized as being both proactive and incorporating operational risk management. The oversight processes for the Army, Navy, and Marine Corps are characterized as reactive and not effectively incorporating ORM.

Identification of a centralized strategy as the most effective is due to the successful

experiences of several systems under centralized strategies as opposed to the less successful experiences under decentralized strategies. This does not mean that a decentralized strategy cannot be effective, but that it is inherently different and has not proven as effective for the majority of systems. The one military oversight system that has not recently experienced systemic problems has a decentralized strategy. The Navy's uniquely high experience level in its officer corps and smaller size, which is less than half the size of both the Air Force and Army systems, may contribute to making a decentralized strategy effective for this service. Whether the approach chosen for oversight of a system is centralized or decentralized, it must be proactive and actively seek safety and improvement. The fact remains that the only systems that currently have proactive strategies—the Air Force and FAA—both have centralized strategies. While a decentralized strategy may be effective, a centralized strategy has proven that it provides greater surety.

In order for the DoD air traffic system to become more proactive and embrace operational risk management, sharing safety data and information is essential. The need for information sharing within DoD and with other agencies and how this is currently done will be discussed in the next chapter.

Figure 3: Comparison of Service Air Traffic Oversight Strategies

Service	Centralized Oversight	Centralized inspection process	Routine system analysis	Preventive safety programs	Overall Oversight: Proactive ? Uses ORM ?
USAF					
USN	■		■	■	■
USMC	■	■	■	■	■
Army	■		■	■	■

■ ■ ■

CHAPTER 5

SHARING SAFETY INFORMATION AND DATA

The movement demanding increasing levels of safety in the NAS and public accountability of the governmental agencies responsible for doing this began after the Airline Deregulation Act of 1978 and appears to have culminated in 1997. In late 1995, David Hinson, then Administrator of the FAA, proposed zero accidents as the only "acceptable goal" for both the FAA and the aviation industry; this served as a rallying cry that initiated several subsequent aviation safety initiatives--all of which focus on sharing safety data as a pivotal element. DoD has answered this call all well as the FAA and the aviation industry and is participating in initiatives both internally and in conjunction with other government agencies to share safety data in an attempt to reduce mishap rates. These initiatives provide an opportunity for the military air traffic community to improve its own methodology for safety analysis and to become increasingly joint, however, air traffic is not included in many of these initiatives.

Governmental Initiatives

Pursuit of the goal of ever-increasing aviation safety garnered presidential interest in 1997 with the formation of the White House Commission on Aviation Safety, demonstrating both its visibility and high level of public interest. The National Civil Aviation Review Commission's final report, issued in December 1997, addresses both aviation safety and funding and appears to have unanimous support from the Clinton Administration and various sectors of the aviation community.[153] In August 1997,

another significant event impacting aviation safety and operations was the first five-year, fixed-term appointment of an FAA Administrator, Jane Garvey. This longer term was specifically implemented to protect the shaping of critical policy and to enhance the scope of aviation safety.[154] Sharing and standardization of safety data are pivotal themes in all of these initiatives that seek to improve both aviation safety and public accountability.

The White House Commission. The White House Commission included a recommendation that the FAA and other government agencies in the aviation community work together to develop safety databases that can be shared in accident prevention programs, culminating ultimately in a worldwide network called the Global Analysis and Information Network (GAIN). GAIN will enhance the aviation industry's ability to identify risks through improved aviation data management, analysis, and access; data will be synthesized from diverse sources to obtain the most complete picture possible.[155] Another recommendation of the Commission is a collaborative research initiative between the FAA, DoD, and NASA into aviation human factors, considered a neglected and potentially critical avenue in aviation safety data analysis to reduce accidents.[156]

The National Civil Aviation Review Commission (NCARC). The NCARC goes a step further than the White House Commission in recommending partnerships by including all sectors of the industry, not just governmental agencies. Support from both public and private sectors has led to optimism that the report will "not collect dust on a shelf" but will result in substantive system improvements. [157] The NCARC declared that the FAA and aviation industry must develop a strategic plan for safety improvements, to include--

> ...stronger emphasis on information sharing and collaborative development of solutions to safety issues,
>
> ...creation of more effective safety risk management programs... such as the

budding self-audit and self-disclosure programs...More use should be made of ...flight and air traffic data to find problems before they cause accidents...[158]

Five-year Appointment for the Administrator of the FAA. The lengthening of the FAA Administrator's term sends a signal that there is substantial support in improving system safety. Much of the foundation of Jane Garvey's aggressive safety agenda is driven by sharing of safety data, described in her own words as "...focused, based on hard data, and doable."[159] She has already forwarded two notices of proposed rulemaking to expand industry use of flight operations quality assurance (FOQA) programs, which are based on the voluntary collection, analysis, and sharing of routine flight operations data.[160]

DoD Initiatives

Initiatives to share safety information in order to improve safety are not limited to agencies outside DoD; several initiatives are occurring to promote collaborative research and sharing of safety information within DoD. Defense Secretary Cohen personally expressed the importance of sharing information to both improve safety and serve the public interest; more open disclosure of the causes of military air crashes could provide additional data that can be used in helping to prevent future accidents.[161] The U.S. Army Safety Center has an initiative intended to share aviation data between the services, called the Risk Management Information System.[162] While the methodology has not been settled between the services as to how the database will operate, the movement to share aviation information between the safety centers has begun. This could provide more detailed information than that currently available in the DoD Aviation Safety Database.

A study at the Naval Safety Center determined that between fiscal years 90-96,

over 80% of all Navy and Marine Corps flight mishaps involved human error, making it the most common denominator in Naval aviation mishaps.[163] In an effort to further study and reduce human error, the Naval Safety Center developed a new methodology for analyzing post-mishap causal factors called the Human Factors Accident Classification System (HFACS). HFACS has now been formally briefed to the Army and Air Force Safety Centers, NASA, and the FAA, and is being considered for adoption throughout DoD and by the Human Factors Engineering Working Group that resulted from the White House Commission.[164] All of these efforts demonstrate the movement toward sharing of safety information, however, air traffic control is not addressed in many of these initiatives.[165]

Does HFACS have applicability for air traffic control or is it only appropriate for application to the flying communities? The three levels of human failure examined in HFACS that are depicted in Figure 4--unsafe supervision, unsafe aircrew conditions, and unsafe aircrew acts--are just as applicable to air traffic controllers as they are to aircrew. For example, Skill Based Errors, seen in Figure 5, are errors in skills that are so highly practiced that they occur without significant thought. These skills are highly vulnerable to failures in attention or memory and can be caused by influences such as task saturation, distraction, or inattention--certainly influences that can impact a controller's performance.[166] Almost all physiological, cognitive, and organizational factors examined in HFACS have direct application to controllers. While HFACS is currently used as a post-accident analytical tool, it would also have great value as a *pre-accident* analytical tool for air traffic control by providing a comprehensive methodology to analyze human

Figure 4.

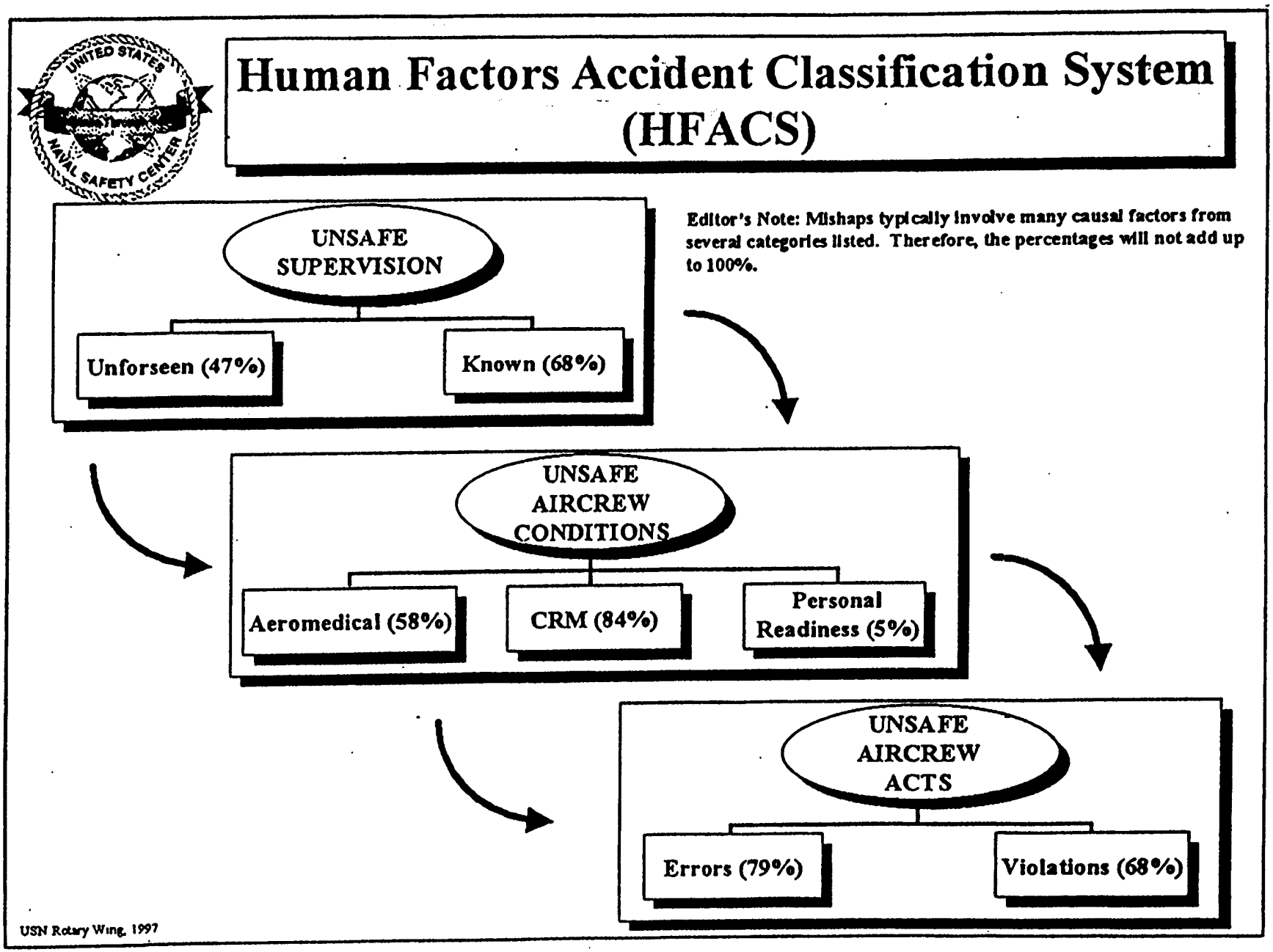
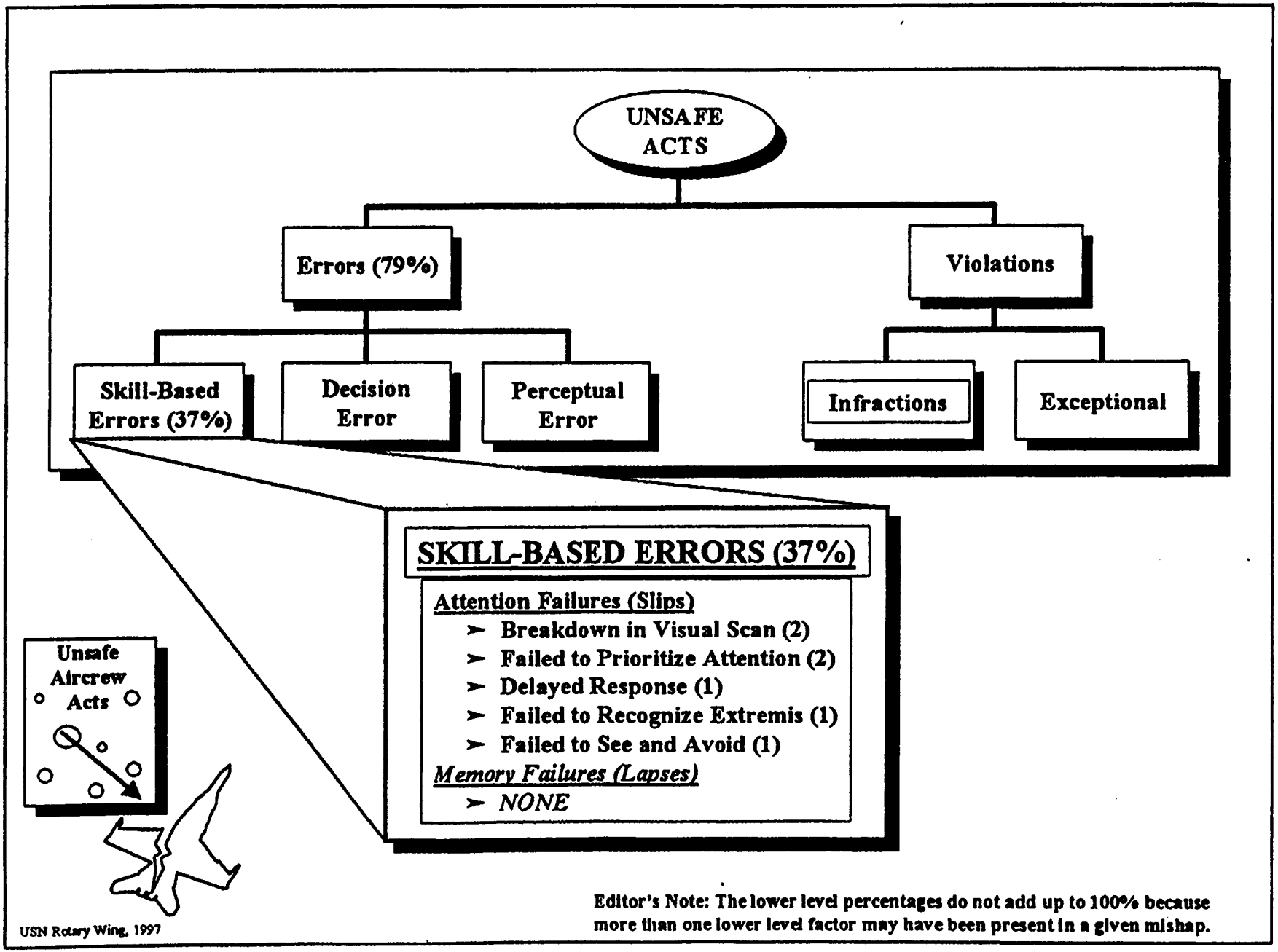

Human Factors Accident Classification System (HFACS)
UNSAFE SUPERVISION
Unforseen (47%)
Known (68%)
Editor's Note: Mishaps typically involve many causal factors from several categories listed. Therefore, the percentages will not add up to 100%.
UNSAFE AIRCREW CONDITIONS
Aeromedical (58%)
CRM (84%)
Personal Readiness (5%)
UNSAFE AIRCREW ACTS
Errors (79%)
Violations (68%)
USN Rotary Wing, 1997

Figure 5: "HFACS: Unsafe Acts -- Skill Based Errors"



Editor's Note: The lower level percentages do not add up to 100% because more than one lower level factor may have been present in a given mishap.

error in incidents such as operational errors.

An additional benefit of increased reporting of safety indicators could result from implementation of assessment using HFACS. Underreporting of incidents has been a problem at times for all services due to several factors, including the perception that disclosure of an incident puts a facility "on report."[167] HFACS is a comprehensive analysis system that looks at conditions at all levels--directives, adequacy of training provided, accountability for correcting previously identified problems, as well as individual or crew performance. If the ATC community believes that HFACS can make a difference in safety, perceptions could change and result in higher reporting of incidents and, consequently, more accurate analysis.

The Army, Navy, and Air Force Safety Centers currently do not share information regarding air traffic system safety indicators or trend analysis on a routine basis. Reports (OHRs, HAZREPs, or HATRs) are only required to be provided to other service Safety Centers if that service's personnel, aircraft, or equipment were involved in the incident; no service directive requires the exchange of data for information purposes routinely.[168] Information is routinely exchanged between the safety centers only in the form of periodicals and newsletters that contain articles on all aspects of aviation. With only one ATCS at both the Air Force and Navy Safety Centers and no ATCS on staff at the Army Safety Center, even this information is sporadic. If a trend in runway incursions were noted in one service, the various experiences and approaches to deal with the problem could provide useful information; additionally, sharing this type of information would more readily identify when a trend is beginning to develop across the services.

The USAFISA study is an example of information that could have been useful if

shared. Only months after the Army study concluded, the Marine Corps began to identify that it had indications of service-wide problems and initiated efforts to charter a Process Action Team (PAT). However, the Marine team had no knowledge that the Army had conducted a similar study and did not have the benefit of being able to leverage off the experiences and methodology of the USAFISA study.[169] Because there is no DoD level mechanism to routinely share or assess information, results of the studies have not been compiled or formally compared to assess trends that may be developing across the services. Both studies, for example, indicate extensive problems in training and manpower. By comparing conditions within the Air Force that contributed to the mishaps in 1992-1994 with problems currently being experienced by the Army and Marine Corps, the parallels offer insight into the value derived from sharing information and lessons learned.

History Repeating Itself

The lessons learned by the Air Force in the wake of the mishaps during 1992-1994 did not substantively influence organization or oversight in the other armed services and history appears to almost literally be repeating itself in the current, systemic problems of both the Marine Corps and Army. Of the nine findings identified in the Inspector General's Special Management Review of the Air Force's air traffic community problems, seven of these same problems are now exhibited in the Marine and Army air traffic communities; the other two findings are reflected in at least one service. A summary of the problems found in the "pre-Pope" Air Force air traffic system and those currently found in the Army and Marine Corps demonstrates that there are many parallels.

Air Force Finding: Lack of detailed directives resulted in reduced standardization between Major Commands. The Air Force report specifically recommended that directives be expanded to provide more detailed guidance; the lack of specificity in the service directives contributed to erosion of standardization. Guidance for the Naval services' inspection program is provided in two paragraphs that provide general guidance; directives neither require nor provide guidance on a quality assurance program or statistical analysis of system data. Army directives do not provide detailed guidance regarding accountability in the inspection process, analysis of inspection results, or sharing results; the Army has no quality assurance program required or described by directives.

Air Force Finding: Inspection program lacked objectivity and depth. The Marine Corps air traffic control system inspection program was deemed to be non-existent in the recent study by the PAT. The Army inspection program was not examined in the USAFISA study, however, the problems in the Army air traffic mission area are so pervasive that the effectiveness of the inspection process, like other aspects of oversight, is in question. A troubling indication that this inspection process may also lack objectivity and depth is seen in the ongoing practice of non-air traffic control personnel inspecting controllers.

Air Force Finding: Turbulence in manpower. Although the issues vary somewhat, manpower problems are a prevalent issue in all three studies. The Air Force had difficulties with assignment policies and problems in training were exacerbated by significant imbalances in controller assignment. Of the six issues identified in the Marine study, four involve manpower issues; the PAT itself was part of a part of a Manpower Quality Management Board. The Army study identifies manpower as impacting every

aspect of the mission area, identifying that 400 more soldiers were needed for the mission area. All studies specifically noted that difficulties in manpower contributed to degradation of both training and controller proficiency.

Air Force Finding: Lack of standardized training. The Marine Corps study identified that training at fixed-base facilities throughout the service lacked standardization. An issue raised specifically in the Air Force, the lack of a simulator for training, was also identified in the Marine study. The lack of standardization in training for the Army was clearly addressed in the USAFISA study, contributing to the system's inability to produce a qualified controller workforce.

Air Force Finding: Lack of technical expertise in leadership. Three of the SMR's nine findings addressed different impacts brought about by declining levels of expertise in leadership and in the overall number of officers. One impact was that commanders, who were no longer controllers, did not understand ATC responsibilities; this same observation is made about the Army mission area. The Air Force SMR noted the absence of an air traffic specialist at the Safety Center and lack of emphasis on the HATR program were examples of a lack of understanding by leadership; the Army currently does not have an air traffic specialist at its Safety Center and reporting of incidents involving air traffic control are virtually non-existent. The experience level of Marine Corps air traffic officers, currently 11-15 months in a fixed-base facility, is substantially lower than that considered necessary by both the Air Force and the Navy, which require five and ten years, respectively, prior to becoming a facility manager. The diminishing experience in leadership, key to maintaining an effective oversight system, was noted as one of the most significant factors contributing to system degradation in the Air

Force and is now noted in the Army and Marine Corps communities.

Air Force Finding: Shortage of E-8s/E-9s. The Air Force SMR indicated potential problems could develop if shortages of E-8s and E-9s resulted from grade rollbacks due to base closures and downsizing. The concern was that this would lead to reduced supervision and was of particular concern in light of the declining experience levels found in officers at the time. The Army has no E-8s or E-9s since the enlisted workforce for the mission area is capped at E-7 and is noted to be of particular concern in the USAFISA study since there are no unrestricted officers or warrant officers. Shortages of E-8s and E-9s were developing concerns for the Air Force, but are now realities for the Army.

Air Force Finding: Recommendations following Pope not implemented. The final finding of the Air Force SMR was that some recommendations for education and corrective action following the March 1994 Pope AFB mishap had not been implemented; the team identified that almost one-fourth of officers and one-third of junior NCOs had not seen any recommendations.[170] While the system was reorganizing and long term corrective action taken, existing mechanisms were ineffective in ensuring immediate corrective action was adequate. The final report on the Army air traffic mission area was published in May 1996, but substantive relief to fixed-base facilities appears to be minimal. While the Marine Corps has taken several actions to rectify the pervasive problems in the air traffic community, a service strategy for the inspection process has not been developed—this was one of the first corrective strategies implemented by the Air Force since this was the enforcement mechanism that could make an immediate impact on improving safety of flight.

Sharing between FAA and DoD

> [The] FAA will achieve its safety goal through regulation, inspection, and certification...To get to zero accidents, however, [the] FAA must go beyond regulation and become a partner with the aerospace community, developing and sharing information and cooperating toward a common goal.[171]

This quote, part of the FAA's strategic vision, illustrates the emphasis placed on sharing information and working closely with all elements of the aviation community. The FAA generates a wealth of information in order to ensure timely, standardized dissemination of information and training throughout the air traffic system. The DoD air traffic community receives a great deal of information from the FAA, however, air traffic performance and safety information is not routinely shared or cooperatively assessed. One example of when this would have been beneficial was in 1996 when both the FAA and the Air Force identified trends in runway incursions. Both were unaware that the other agency had a similar problem, consequently, the FAA's Surface Error Reduction Program developed to address this trend was not shared with the Air Force.[172]

Routine FAA training programs could also benefit the DoD air traffic community. For example, the FAA humans factors program for air traffic controllers--similar to DoD's crew resource management training--called the Air Traffic Team Enhancement (ATTE) program, has the following goals:

- To encourage controllers to work as team members rather than as solo performers
- To improve controllers' abilities to manage their personal and team resources more effectively
- To enhance controllers' abilities to relate to one another
- To enhance controllers' team communication and problem-solving skills[173]

ATTE seminars last for three days and teach an understanding of teamwork in an air traffic environment, communication, conflict management, and stress management. CRM is now a standard aspect of DoD aircrew training, but only the Air Force is

developing an ATTE equivalent within the DoD air traffic control community. Additionally, there is no arrangement to routinely train all military controllers in FAA ATTE seminars.

Conclusion

Sharing of safety data and information is instrumental for continuous improvement of air traffic system safety. DoD is participating in many initiatives that seek to share this information and enhance safety, however, air traffic control is not included in many initiatives and current information sharing between the services regarding air traffic system performance is limited.

Enhanced interagency sharing of training and safety information between the FAA and DoD could provide an additional tool to promote system-wide standardization and safety. Working cooperatively to address air traffic system safety issues in a routine, proactive manner would strengthen the interagency relationship between FAA and DoD and better prepare this partnership to serve national security interests. The importance of this is specifically addressed in the 1997 National Security Strategy:

> Our response to these [diverse] threats is not limited exclusively to any one agency within the U.S. Government. National security preparedness--particularly in this era when domestic and foreign policies are increasingly blurred--crosses agency lines; thus, our approach places a premium on integrated interagency efforts to enhance U.S. security.[174]

CHAPTER 6

ANALYSIS AND RECOMMENDATIONS

> Are the current oversight mechanisms for the military air traffic system capable of ensuring adequate system performance and safety now and in the future by being **centralized**, **proactive**, and **sharing safety information**?

Before this central question of this research project can be answered, it is important to clarify that the Federal Aviation Administration has entrusted oversight of the military air traffic control system to the Department of Defense to ensure that it both complies with standards and provides acceptable levels of service and safety. With only a few minor exceptions, the FAA is neither involved in nor reviews conduct of any DoD air traffic system oversight processes. Inspections, quality assurance, and certification are deferred to DoD to allow the highest degree of flexibility in meeting the unique demands of military training and operations. The DoD air traffic system has unique responsibilities in that it both supports the National Airspace System and serves as a major component of the armed forces' sustainment base. Balancing these inherently difficult missions is made more challenging by the turbulence of the current air traffic environment brought about by increasing system volume, downsizing, technological change, globalization, and increasing involvement in operations other than war. Therefore, oversight of the safety and performance of the military air traffic system is a critical responsibility that rests solely on DoD's shoulders.

Four **conclusions** are drawn about the adequacy of current oversight:

- The most effective oversight approach utilizes a risk management based strategy.

- An effective risk management strategy is centralized, proactive, and shares safety information.
- Risk management is not effectively incorporated in the military air traffic system since only one armed service substantively utilizes risk management.
- DoD needs to incorporate risk management into air traffic oversight in a joint, systems approach.

The most effective oversight approach utilizes a risk management based strategy.

To prevent vacillation in system performance such as that experienced in the air traffic systems of the FAA, the Air Force, the Army, and the Marine Corps, a risk management based strategy for oversight must be utilized. Essentially, management must be able to perceive and address slight variances in system performance so that they are not allowed to develop into serious problems and must seek continuous system improvement; both the FAA and Air Force offer models that effectively achieve this. Risk management is required by Department of Defense policy; although the philosophy and methods used to identify and control hazards have been utilized intuitively and experientially for years in DoD, this process was recently formalized to provide additional emphasis in the current environment of increased visibility and reduced resources. DoD's operational risk management policy uses a comprehensive, systems approach that assesses all elements of a system and their interaction; as perhaps the most complex "system of systems" in DoD, the air traffic system would benefit from a risk management methodology.

A risk management approach was adopted by the FAA and the Air Force when they changed their air traffic oversight from reactive to proactive approaches. Prior to reorganization, the NTSB assessed the FAA's quality assurance and safety oversight as

reactive after a series of errors evoked little response from the FAA and allowed serious system deficiencies to remain unresolved for over three years. By adopting a proactive, risk management based oversight strategy, the FAA now has a system that continuously seeks improvement; this approach maintains the focus on safety, promotes continuous assessment, and provides advocacy at all levels for problem resolution. Following the 1990 reorganization, the Air Force ATC oversight system became increasingly reactive as seen in reduced emphasis on both the HATR and facility inspection programs. Even after systemic problems were identified, the system did not react decisively to resolve these problems until mishaps gained significant visibility. The Air Force system then adopted a risk management based oversight strategy and is more responsive in identifying and resolving problems as recently demonstrated by identification and system-wide resolution of an MSAW problem in only three days.

Essentially, a risk management approach institutionalizes proactive oversight of the air traffic system by requiring early identification of hazards, continuous assessment of hazards, and development of management controls to reduce risks. Without an intentional process to manage risk, system performance and safety will be haphazard.

An effective risk management strategy is centralized, proactive, and shares safety information.

Since the heightened concern for aviation safety following airline deregulation, several studies and air traffic system reorganizations have demonstrated that delegating oversight to levels below the national/executive agency can lead to inconsistent interpretation of safety regulation across regions or subordinate commands. The Aviation

Safety Commission assessed the FAA's then decentralized oversight model as inadequate in seeking continuous improvement and ensuring safety in the future. The commission recommended several processes be centralized by moving them from the regional to national level in order to minimize interpretation of standards, avoid complacency, maintain process objectivity, and promote sharing of the diverse experiences found throughout the system. Following the commission's study, two air traffic systems—the FAA and the Air Force—experienced the following systemic problems under decentralized strategies:

- Problems not identified
- Problems that were identified went unresolved
- Inspection process became less rigorous and objective

When FAA oversight was delegated to the regional level, several NTSB reports cited oversight as reactive and unable to detect a sudden increase in errors or to ensure accountability in problem resolution; serious problems like those identified at Coast TRACON went unresolved for up to three years. Similarly, the Air Force experienced a decline in standardization, turbulence in manpower, and declines in experience levels of leadership as a result of delegating system oversight to the major command level. Notably, there was a substantial reduction in emphasis and effectiveness of the inspection process which had previously provided detailed assessments. A hard lesson learned through assessment of post-mishap conditions was that the inspection process must be maintained at the service-level in order to keep it objective and rigorous. The Air Force demonstrated the criticality of a centralized inspection process being one of the first corrective strategies implemented.

A third system--the Army--currently has a decentralized organizational structure

and system oversight that have allowed degradation of both performance of the air traffic system and combat readiness of the mission area. The USAFISA study of the Army air traffic mission area was requested specifically to assess the effects of a 1986 reorganization that removed air traffic units and facilities from a central organization and placed them under myriad subordinate commands. This organizational structure allowed the present conditions to develop and although the Army has not yet begun reorganization, the strategy identified as most effective to manage the mission area is a centralized one.

Both the FAA and Air Force have adopted more centralized strategies that have proven more effective than their previous decentralized strategies. The FAA's centralized oversight strategy has improved communication and accountability both up and down the lines of authority. The Air Force has also experienced success under centralized oversight, demonstrating that this strategy is valid and beneficial for a military system as well as a civil system.

In a military system, a highly centralized approach might appear to inhibit development of initiative in subordinates and flexibility that could be detrimental to mission accomplishment. However, rigid standardization is desirable in both the daily operation and oversight of an air traffic system, whether civil or military. While decentralization of many functional areas is desirable for the military, decentralizing the safety regulatory mechanism for air traffic can degrade both safety and readiness.

One mechanism that is required for a proactive oversight strategy is a quality assurance program. Both the Air Force and FAA models have quality assurance programs that require routine communication, assessment, and continuous improvement by all

system elements. The FAA ATC QA program does not offer evidence as to its effectiveness since it was promulgated in February 1998; it does, however, demonstrate the continuing emphasis of the FAA model in maintaining a proactive posture and further recognition that a quality assurance program should be formally articulated. One mechanism of the Air Force QA program, the AOB, has demonstrated its effectiveness in proactive oversight by identifying a trend that was unable to be identified through other sources.

Routine analysis of system safety data is another indicator that an oversight strategy is proactive. By routinely assessing system safety data and information, problems can be identified early and addressed before they are manifested in serious incidents or mishaps. Statistical analysis is one of the primary measures of system effectiveness and safety in the FAA model as evidenced by the Director of Air Traffic receiving a personal briefing every morning on system data. Additionally, a recent rise in the operational error rate resulted in the implementation of a system-wide corrective strategy within months. The Air Force model also places significant importance on system assessment as demonstrated by general officer review of quarterly and annual air traffic system analysis reports at both the major command and service levels.

To continuously improve the data analysis process and ultimately, system safety, current safety initiatives throughout the aviation industry have identified sharing safety data and information as a key element of accomplishing this goal. These include DoD initiatives such as the Risk Management Information System database, governmental initiatives such as the White House Commission on Aviation Safety, and initiatives that encompass the entire aviation industry such as the National Civil Aviation Review.

Information sharing of lessons learned between the services can prevent reoccurrence of deficiencies and promote continuous system improvement by learning from the failures and successes of all military systems; it could also help identify and quantify trends developing across the services. The studies conducted by the Air Force, Army, and Marine Corps all provide examples of valuable information that could assist the other services. Joint information sharing could also provide a means to articulate impacts and requirements more effectively, such as quantifying the effects of downsizing on operational effectiveness in the DoD air traffic system.

Interagency sharing of routine safety information and training information is not exploited as effectively as possible; ATTE is an example of human factors training by the FAA that has not been adopted DoD wide, but could provide training benefits at little cost. Enhanced sharing of training and safety information between the FAA and DoD could promote the interagency relationship in support of national security interests, optimize resources that have application for both systems, and build upon the diverse experiences of both agencies.

While recent studies and the success of air traffic system oversight models demonstrate that a centralized, proactive strategy is most effective for the military air traffic system, only one service currently has a risk management based strategy. The various service strategies will be assessed and compared below.

Risk Management is not effectively incorporated in the military air traffic system since only one armed service substantively incorporates risk management. The Air Force air traffic control oversight model is the only one in the armed services that

currently incorporates a risk management approach. The Air Force model has been discussed above and this assessment, therefore, will focus largely on the other armed services' oversight systems. An oversight process that incorporates risk management is characterized by being centralized, proactive, and having a quality assurance program. Each service will be assessed to determine how effective each their oversight strategies are in incorporating these characteristics.

Is DoD's Air Traffic Oversight Strategy Centralized? Current oversight of the DoD system is decentralized and is not centrally accomplished; each service maintains individual responsibility for oversight of its air traffic system. Oversight is not standardized since each service utilizes a distinct methodology; there is no higher level or joint review of individual service oversight to ensure standardization and adequacy. There is no joint forum that routinely deals with joint operational and safety issues of the military air traffic system and no objective mechanism to identify when an individual service system is deteriorating or when trends are developing across the services. System oversight is decentralized further by three of four armed service strategies delegating oversight to subordinate commands.

The ineffectiveness of a decentralized strategy was identified previously as not ensuring consistent performance or early hazard identification; the Army, Marine, and Air Force systems all developed serious, systemic problems that degraded both safety and readiness before they were identified. The Air Force subsequently adopted a centralized strategy that has improved oversight for its air traffic system and this offers an effective model for the other services. The Air Force centralized strategy holds all levels in the system accountable to the service's executive agency, maintains routine communication

between all levels, and routinely assesses system performance. In order for an executive agency to execute this type of a strategy, it must have sufficient staff and adequate technical expertise to support the high level of detail and technical nature of issues.

Oversight by the Naval services is decentralized with system accountability delegated to the TYCOM level; the executive agencies are not involved in the oversight process. Both the Navy and Marine Corps have also delegated the inspection process to the TYCOM level and the executive agents neither participate in nor assess information derived from the process; with this decentralized approach, the Marine inspection process deteriorated significantly before this was identified. Oversight of the Army system is not effectively centralized; while the inspection process is physically centralized in one team, accountability is not effectively centralized. The ineffectiveness of the Army's decentralized strategy was demonstrated in USAFISA assessment's of the mission area proponent as ineffective and the entire mission area as having serious, pervasive problems.

The Army, Navy and Marine Corps all have decentralized oversight processes; the Air Force has the only effectively centralized oversight strategy.

Are Service Strategies Proactive? Three elements of air traffic oversight for each service determine the degree that each strategy can be characterized as proactive: the inspection process, the data analysis process, and quality assurance programs. The experiences of the FAA, Air Force, and Marine Corps illustrate deterioration in objectivity, accountability, and overall effectiveness; delegation of these processes to subordinate agencies contributed significantly to this deterioration. The inspection processes in the Army, Navy and Marine Corps do not have centralized oversight and the executive agencies are not involved in scheduling, conduct of inspections, reporting of

results, or discrepancy resolution. None of these services currently compile or assess service-wide inspection results to discern trends or quantify system problems.

The Navy inspection program has not demonstrated degradation, attributable perhaps to this service's air traffic officer experience level being significantly higher than any other service. While this strategy appears to be successful for the Navy, the FAA--with high experience levels in management also--determined that a decentralized model was inadequate to ensure accountability and standardization. Within DoD, only the Air Force has completely centralized accountability, reporting, and assessment in its inspection process.

Like other facets of the DoD oversight process, there is no centralized, routine compilation or assessment of statistical data on the military air traffic system. Statistical analysis of system safety information and data could promote early identification of problems and assist in identifying and obtaining requirements for the service communities, however, three services do not routinely conduct system-wide analysis. Only one service routinely incorporates this proactive analytical tool into its oversight process, the Air Force. Quarterly and annual system assessments are published that are a compilation of all data gathered from inspections, the HATR program, Airfield Operations Board minutes, and other sources. In the other three services, neither the executive agencies nor the service safety centers compile all system data and conduct routine analysis of system safety indicators. In these services, hazards are not identified and there is neither sufficient data nor staff to conduct detailed analysis. Consequently, assessment cannot be accomplished effectively and management controls cannot be developed to reduce risks since the tools needed to do this are not all present.

The third element characterizing proactive oversight is the existence of a quality assurance program that seeks to promote communication and continuous system improvement. Both the Air Force and FAA offer recent examples of early problem identification and resolution that demonstrate the effectiveness of their quality assurance programs. The Air Force Quality Assurance Program consists of four focus areas and eight individual programs within those areas; directives require specific actions, assessment, and reporting at specified periods—down to the individual facility level. The FAA program has four focus areas that are required to be incorporated into QA programs at the facility and regional level; interaction between all levels is required routinely. Both QA programs take a comprehensive systems approach through routine communication and system assessment that are required by directives. The Army, Navy and Marine Corps do not have quality assurance programs or requirements that provide an equivalent process to promote system-wide communication and process improvement.

Only one service has an oversight system with all the characteristics of an effective, risk management based program. Air Force oversight is centralized, conducts routine analysis of system indicators, and has a quality assurance program. The other services' oversight strategies are not centralized, are reactive, and do not have quality assurance programs. Their oversight structures do not routinely incorporate the risk management methodology of early identification of hazards, assessment of hazards, and implementation of management controls to control hazards. Therefore, the Air Force's air traffic oversight strategy effectively incorporates risk management and the Army, Navy and Marine Corps air traffic oversight strategies do not.

DoD needs to incorporate risk management throughout the military air traffic system; this can only be done effectively with a joint, systems approach to oversight.

While three of four services are assessed as having reactive rather than risk management based oversight strategies, this is not intended to assess the entire system as unsafe. It does, however, suggest that current oversight mechanisms do not continuously seek optimum system performance, provide the highest degree of safety surety possible, or routinely recognize and optimize opportunities. Maintaining consistency can be more difficult in an environment of turbulence due to shifting priorities and resources, increasing the possibility that system performance may be impacted. Many of the Air Force's problems were the result of changes in Air Force policy and procedures to accommodate downsizing—there was no risk management process to assess these actions and determine if they presented potential hazards for the unique functioning of the air traffic system and community.

Similarly, the Marine Corps air traffic community reorganization was largely the result of downsizing and there was no air traffic system risk management mechanism to assess the impact of this action on overall system performance and safety. The Army reorganization, also directly linked to downsizing efforts, had no process that identified and assessed the potential risks of this action so that a conscious decision to accept or not accept the associated risks could have been made. An overarching, centralized oversight mechanism for the DoD air traffic system is needed to assist the services in negotiating through the white water rapids of change; this is needed now, as evidenced by the difficulties that services are currently experiencing in resolving identified problems.

Had the lessons of the FAA and Air Force's experiences been incorporated into

the other services' strategies, or if there had been a joint forum for oversight or sharing system information to collectively draw upon experiences, it is possible that the current problems could have been significantly mitigated. Both the Army and Marine Corps studies identified organizational, manpower, and training deficiencies for both the air traffic controller and maintenance communities. However, the Marine Corps began its own internal assessment without any knowledge that the Army had concluded a similar and highly detailed study only a few months before. The commonality in both tactical and fixed-base missions between these two services is high and a cooperative effort could have saved manhours, accelerated corrective action, and identified trends developing across services--but the mechanisms were not in place to do this. Oversight of the military air traffic control system is not joint but is fractured and does not take advantage of learning opportunities or utilize a comprehensive systems approach.

The bottom line. The armed services face a difficult environment as they attempt to balance diminishing resources with growing missions. Regardless of the level of external pressures at any particular time, the mechanisms that ensure consistent performance and safety in the air traffic system must be rigorous and seek continuous improvement. This not only makes sense, but it is also DoD policy as articulated in the operational risk management programs. The mechanisms are not consistently in place throughout the DoD air traffic system currently to detect developing problems or to seek continuous system improvement. Oversight is not centralized—either at the DoD level or within three services. Most of the services do not conduct routine analysis of system indicators and air traffic has not consistently been an area of emphasis for the safety

centers. Sharing of information between the services and the FAA is limited and does not best support efforts to improve aviation, does not promote learning from diverse experiences, and does not provide a routine rapport to optimize resources and personnel. Additionally, routine opportunities for the military air traffic system to work and train together and develop a truly joint community are being missed.

The degree of safety that exists within individual services or collectively within the military air traffic system cannot accurately be determined at this point due to lapses in documentation and oversight processes. What can be identified at this point, however, is that the current safety regulatory structures for the armed service air traffic control communities are not as effective as they could be and that opportunities to provide greater assurance of safety, realize efficiencies, and improve readiness are not being fully exploited. Recommendations to these ends are offered below.

RECOMMENDATIONS

Develop a Joint ATC System Safety Management Strategy. Each of the services offers a different model for oversight but only one offers an effective strategy for system oversight. It would be advantageous for all of the armed service communities to adopt a standardized oversight strategy to facilitate information sharing and promote interoperability and joint training. In order to do this, the Department of Defense needs to view all military air traffic facilities as a single system and develop a strategy to ensure that assessment and regulation of system safety is both consistent and proactive. This strategy should be based upon the Air Force's centralized oversight model and should consider the following:

Joint forum to develop a risk management based strategy. A joint forum should be established to develop a proactive, joint strategy that will ensure consistent and safe functioning of the military air traffic system. This forum must have mature technical expertise and adequate interface with the military air traffic system to maintain situational awareness of the changing air traffic environment. Air traffic control specialists from all the safety centers should participate in this forum. The joint safety strategy should specifically require a standardized operational risk management process for the military air traffic system at all levels.

Safety Center Staffs. In order for this joint air traffic safety forum to be effective and for progress to be made in making the air traffic oversight process more proactive, the Safety Centers must have adequate manpower to support this effort. Staffs are currently inadequate to do this and additional air traffic control specialists should be provided at each safety center.

Joint safety database. A joint database that contains detailed information regarding the military air traffic system should be implemented, similar to efforts that have been implemented at the FAA and the military Safety Centers for the flying communities. The database could be accessed at whatever levels are determined necessary to share information on mishaps, incidents, trends, or other data. Other information could be incorporated for joint use; manpower, for example, could also be tracked in this database to "joint source" controllers for deployments, training, or other joint efforts. This joint database could prepare the DoD air traffic community to be participants in the GAIN initiative if this is determined to be needed.

Joint incident reporting format. In order to make a common database and analysis methodology effective, reporting of all system safety indicators must be accomplished in a standardized, joint format.

Incorporation in HFACS. HFACS should be evaluated for its suitability as an analytical tool for the air traffic community; if applicable, air traffic should be included in its development and implementation.

Annual assessment of DoD air traffic system. The joint air traffic safety forum should conduct a comprehensive, annual assessment of the military air traffic control system's performance and safety. Methodology for follow-up of problems should be identified in the joint air traffic strategy.

Establish an Interagency Air Traffic Safety Partnership. Although there are many ties regarding air traffic between the FAA and DoD, none routinely share safety information in a real-time, operationally focused manner. In order to most effectively comply with the public law, optimize resources, and mutually benefit from both agencies' experiences, the *Secretary of Defense should initiate a safety partnership with the FAA* to strengthen and focus the interagency relationship through operational interface of the safety regulatory mechanisms. This partnership could include:

Share annual assessment. Sharing information from the annual military air traffic system assessment can develop interagency understanding, identify where resources can be shared for mutual benefit, and support achievement of the White House Commission's goals of sharing safety information and improving system safety.

Rewrite the 1969 Interagency MOU. The Secretary of Defense should request that the 1969 interagency agreement (MOU) be rewritten to establish a partnership between the two agencies specifically designed to cooperatively oversee system safety. The MOU should mandate ATREP assignment and require and define ATREP participation in the FAA-DoD air traffic safety partnership. The assignment and duties of FAA Air Traffic Representatives should be specifically defined in the language of the MOU.

Quality Assurance Partnership. Military air traffic control specialists should be assigned to the Air Traffic Investigations and Evaluations Branch to develop the interagency safety partnership and to oversee interagency quality assurance efforts nationwide. By working in the heart of the NAS oversight process, these specialists will be best positioned to engender mutual trust and understanding required for an effective partnership.

Assessment of current status of the military air traffic control system. Several studies noted in this research raise concerns about the overall health of the military air traffic system and the ability of individual systems to identify and correct problems. However, it was not within the scope of this study to determine the exact nature or extent of these problems or the degree to which individual systems are capable of correcting problems. The Secretary of Defense should direct that a comprehensive evaluation of DoD air traffic systems—both fixed-base and tactical and how they interrelate—be conducted to provide a baseline to assess current issues and capabilities as well as system safety and functioning.

CHAPTER 7

CONCLUSION

The most striking aspect of the concerns voiced in the recent Army and Marine studies identifying organizational and operational problems is their chilling similarity to those voiced by the Air Force just prior to the three incidents in 1992-1994 that resulted in the deaths of over 200 soldiers and airmen. The Air Force took swift and decisive action to rectify safety problems so that their system would be attuned to developing problems; they clearly did not want to ever again wait for mishaps to get service level attention for air traffic problems. There were many lessons to be learned for all military air traffic systems, unfortunately, the other U.S. armed services did not learn from the Air Force's traumatic loss of life, property, and prestige in those incidents.

The Air Force's 1994 reorganization introduced the most highly centralized oversight strategy to date for the military air traffic system. The success of both the FAA and Air Force oversight systems demonstrates that a centralized strategy most effectively ensures standardization in system performance and safety, promotes early identification of problems, and provides redundancy in system "checks and balances." This strategy is the optimum method to promote continuous system improvement and, therefore, to incorporate the Secretary of Defense's operational risk management initiative into the military air traffic community.

It is clear that the FAA has entrusted DoD with almost all aspects of oversight for air traffic system performance and safety to accommodate the unique demands of military training and readiness. This autonomy is essential in providing DoD the latitude needed to assure both security and flexibility; however, this autonomy also brings with it the

difficult responsibility of maintaining a consistent, unwavering level of air traffic system functioning in a world whose very nature thrives on dynamic change and adaptation.

Only one of four services currently has an air traffic system regulatory structure that aggressively attempts to ensure consistently high levels of performance, safety, and continuous system improvement. If the other services' air traffic systems have gradually become less safe due to shifting priorities and "doing more with less" during the drawdown and budget cuts, their oversight structures may or may not be able to identify that this is happening. For these systems to ensure the highest levels of air traffic system safety and military readiness, they should adopt more centralized and proactive oversight strategies. For the Secretary of Defense to ensure that all national interests are effectively served, the military air traffic system must be viewed and managed as a single entity with a joint oversight strategy that actively incorporates operational risk management. This joint strategy can concurrently enhance combat readiness while improving system safety.

Sharing of safety data and information is instrumental to continuous improvement of air traffic system safety; however, the military air traffic system currently shares only limited information--both internally and with the FAA. The lack of focus on air traffic has resulted in its omission from several current initiatives within DoD to improve aviation safety that have applicability for the air traffic community. Air traffic safety information and data must be shared within DoD to facilitate a joint safety regulatory structure and also with the FAA to strengthen interagency ties and begin to forge a partnership that focuses the entire system on safety.

Joint, centralized oversight of the military air traffic control system not only supports the concept of a "common system of air traffic control" envisioned in the public

law, but it also promotes a joint air traffic community that can provide the safest flying environment during peace and best prepare its workforce to fight and win wars, both now and in the future.

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